

MMTS OU III Upper Montezuma Creek DOE ID Nos. MG-00951-VL, MG-00990-CS, MG-01026-VL, MG-01033-VL, and MG-01084-VL Removal Action Design

May 1998

MRAP OU III AR 601 4-31 MONTEZUMA CREEK
MMTS OU III UPPER MONTEZUMA CREEK REMOVAL
ACTION DESIGN 5/98



U.S. Department
of Energy

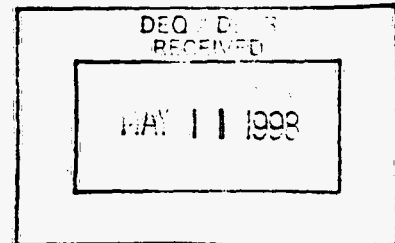
GRAND JUNCTION OFFICE

Monticello Mill Tailings Site
Operable Unit III

Upper Montezuma Creek
DOE ID Nos. MG-00951-VL, MG-00990-CS,
MG-01026-VL, MG-01033-VL, and MG-01084-VL

MAY 1998

Removal Action Design



May 1998

Prepared for
U.S. Department of Energy
Albuquerque Operations Office
Grand Junction Office

Prepared by
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Grand Junction, Colorado

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Attachments

<u>Sheet</u>	<u>Abridged Drawing No.</u>	<u>Title</u>
1	E04079	Title Sheet
2	E04080	Project Site Plan
3	E04081	Excavation Plan
4	E04082	Excavation Plan
5	E04083	Excavation Plan

Attachments (continued)

<u>Sheet</u>	<u>Abridged Drawing No.</u>	<u>Title</u>
6	E04084	Excavation Plan
7	E04085	Excavation Plan
8	E04086	Excavation Plan
9	E04088	Irrigation Pond
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1.0 Introduction

This Removal Action Design for Upper Montezuma Creek was prepared for the U.S. Department of Energy (DOE), Grand Junction Office (GJO) in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act and the Superfund Amendments and Reauthorization Act, Section 120, and Executive Order No. 12580. The U.S. Environmental Protection Agency (EPA), DOE, and the State of Utah entered into a Federal Facilities Agreement in December 1988 to complete remedial action at the Monticello Mill Tailings Site (MMTS) in Monticello, Utah. The Action Memorandum for Operable Unit (OU) III of MMTS (in progress) describes the removal action to be completed for Upper Montezuma Creek. OU III also includes contaminated surface water and groundwater, but remediation of those media are not included in this removal action. DOE, as the responsible party, must prepare the necessary documentation for planning, selecting, and implementing all remedial and removal actions for Upper Montezuma Creek. This removal action meets all applicable or relevant and appropriate requirements (ARARs), which are evaluated in Appendix B. Section 5.1 discusses how this design complies with applicable ARARs. This design package is part of the removal action implementation for OU III.

2.0 Purpose

The purpose of this design package is to plan for implementation of the necessary action required to excavate approximately 6,175 cubic yards (yd^3) of assessed contaminated soil and sediment exceeding 35 microrentgens per hour ($\mu\text{R/hr}$) of gamma-ray emissions from the Upper Montezuma Creek, as described in the Action Memorandum for OU III. This design package includes the radiological assessment, the recommended removal action, an evaluation of ARARs, a summary of the estimated volume of material to be removed, and the estimated cost of the proposed action at Upper Montezuma Creek.

The attached design drawings present a general description of the area and the work required on the property. The design is based on the removal action requirements discussed in this report, and the Radiological Assessment and ARARs presented in Appendices A and B, respectively. Removal action will be completed in conformance with the DOE *Monticello General Construction Specifications* (revised April 1997).

3.0 Property Descriptions

Upper Montezuma Creek includes DOE Property ID Numbers MP-00951-VL, MP-01084-VL, MP-00990-CS, MG-01033-VL, and MG-01026-VL, as shown on Sheet 2 of the design drawings. These properties total 321.72 acres, of which only the areas immediately adjacent to Montezuma Creek will be disturbed by this removal action. The actual area of expected disturbance is 6.7 acres. Monticello Creek meanders through the approximate center of the properties. The OU III contaminated areas are defined by areas immediately adjacent to Montezuma Creek. The areas designated as MG-00951-VL, MG-00990-CS, and MG-01084-VL are the OU III areas within MMTS OU II Monticello Peripheral Properties MP-00951-VL, MP-00990-CS, and MP-01084-VL. Because the only contamination that exists on properties MG-01026-VL and MG-01033 is in the OU III boundary, the entire properties are identified as "MG" properties.

This removal action design package includes specifications for the removal of radiologically contaminated materials from the five properties in the Upper Montezuma Creek area as shown on the design drawings. The Upper Montezuma Creek area begins approximately 0.5 mile below the Monticello

Millsite at the western boundary of Monticello Peripheral Property MP-00951-VL. The area starts at survey grid Easting (E) 25400 and extends approximately 8,750 feet (ft) along Montezuma Creek to E31800. Elevation ranges from 6,770 ft above mean sea level (MSL) at the western boundary of the Upper Montezuma Creek area to 6,650 ft above MSL at the eastern boundary. In the western portion of Upper Montezuma Creek, the creek is channelized and high flows are contained within the banks. In the eastern portion, the canyon narrows and Montezuma Creek begins to meander more frequently and remnant beaver ponds become more prevalent along the eastern margin.

Properties MP-00951-VL, 28.73 acres in area, and MP-01084-VL, 60.0 acres in area, contain primarily irrigated and nonirrigated pastures with some piñon/juniper and oak brush tree areas. The properties slope gradually from Clayhill Drive to Montezuma Creek. The properties then slope up from the creek, to the south property lines. The Monticello Peripheral Property areas of these properties were remediated by DOE during the 1996 construction season. The properties were recently purchased by new owners who are currently using the area as an elk ranch. The OU III portions of the properties along Montezuma Creek are designated wetlands. An irrigation pond with a concrete dam structure is located in the creek channel on MP-01084-VL. The pond is currently silted full and is not functional.

Property MP-00990-CS consists of 96.9 acres, of which the majority of the property is vacant land with areas of piñon/juniper trees, oakbrush, and native grass vegetation. The property slopes gently to the southeast towards Montezuma Creek, which traverses the southern portion of the property. 1.7 acres of this property outside of the OU III area were remediated by DOE during the 1997 construction season.

Properties MG-01026-VL, 55.94 acres in area, and MG-01033-VL, 80.16 acres in area, are located in the eastern portion of Upper Montezuma Creek. Within MG-01033-VL and throughout MG-01026-VL the creek valley is narrow and the canyon is steep sided. This portion of the canyon consists primarily of hillsides covered with piñon/junipers and oak brush; the creek area consists of wetlands and riparian areas, and beaver ponds.

Legal descriptions for the properties are presented in Appendix C.

3.1 Removal Action Cleanup Levels

A complete radiological assessment was performed on the properties to determine the extent of contamination exceeding the 40 CFR 192 cleanup standards (see *MMTS, Operable Unit III, Remedial Investigation*, DOE 1997). After a Baseline Risk Assessment was performed (see *MMTS, OU III, Remedial Investigation*, and *Alternatives Analysis for Soil and Sediment in Upper Montezuma Creek, Middle Montezuma Creek, and Lower Montezuma Creek Reports*, DOE 1997), a risk management decision by DOE, EPA, and the State of Utah established a 35- μ R/hr alternative action level (cleanup level) for this removal action. The areal locations of these 35- μ R/hr areas were located using field gamma scintillometers to identify the boundary of each contaminated area. These areas were subsequently surveyed for use in field and design drawing layout. Consistent with "As Low As Reasonably Achievable" (ALARA) guidance and to minimize environmental damage, areas exceeding 35 μ R/hr located downstream of a remnant beaver pond on Property MG-01033-VL (survey grid E30570) will not be remediated.

This removal action requires removal of contaminated soil and sediment with surface gamma exposure rates that exceed 35 μ R/hr (approximately 8 picocuries per gram [pCi/g] radium-226 [Ra-226]) and application of institutional controls in the form of a restrictive easement. The restrictive easement will not allow residential development within contaminated areas. Excavation within the areas that exceed 35 μ R/hr will continue at depth until the concentration of Ra-226 is less than 15 pCi/g above

background. This removal action meets the threshold criteria (i.e., protection of human health and the environment and compliance with ARARs), minimizes the short-term adverse effects of remediation, is cost effective, applies the principles of ALARA, and is not inconsistent with the landowners' preferences.

The residual reasonable maximum exposure (RME) risk from the proposed action will be 3.9×10^{-5} incremental lifetime cancer risk (ILCR), which is within the risk range of 1.0×10^{-4} to 1.0×10^{-6} ILCR specified in the National Contingency Plan. The residual central tendency risk will be 4.0×10^{-6} ILCR. The residual RME risk considers exposure to contamination left in place over all areas of Upper Montezuma Creek.

Compliance with 40 CFR 192 in the areas not remediated to the 5 and 15 pCi/g Ra-226 standard (all areas of Upper Montezuma Creek) will be accomplished by applying supplemental standards. Application of supplemental standards is based on the criterion in 40 CFR 192.21(b): remediation to 5/15 pCi/g Ra-226 in Upper Montezuma Creek would cause environmental harm that is excessive compared to the health benefits of remediation. The supplemental standards application will include the requirement for long-term surveillance and maintenance and 5-year reviews.

This design package addresses removal of deposits of contamination that exceed 35 μ R/hr of gamma-ray emissions. In order to minimize environmental impacts that remediation to 40 CFR 192 standards would cause, DOE, EPA, and the State of Utah jointly developed the 35- μ R/hr alternative action level. The areas that are designated for removal action will be remediated to meet the 40 CFR 192 standard. Excavation will stay within the 35- μ R/hr delineated areas; no lateral chasing will occur. This approach will minimize the areal extent of remediation, which will reduce disturbance of the environmentally sensitive area. The remaining material exceeding 40 CFR 192 standards will be included in a forthcoming supplemental standards application. Approximately 3.23 acres of upland/riparian areas and 1.09 acres of wetland areas will be affected by the removal action. Table 1 presents the total area for each Upper Montezuma Creek property and the OU III boundary area, and indicates the total estimated contaminated areas exceeding 40 CFR 192 standards, the contaminated areas and volumes exceeding the alternative cleanup level of 35 μ R/hr, and volumes associated with contamination left in place and removed.

4.0 Property Owner Concerns

Properties MP-00951-VL and MP-01084-VL have the same property owners who live on adjacent property MP-01083-MR along Clayhill Drive north of Montezuma Creek. The owners purchased the property in 1997 and are developing it as an elk ranch. They are concerned that because the roadway from their house to Montezuma Creek is currently only a dirt road, the use of it by construction equipment will cause excessive rutting and damage to it. In order to mitigate road damage, the design includes a granular subbase being placed on the road prior to commencing remediation to support the construction equipment. Upon project completion, the roadway will be regraded and repaired. The owners also have requested remediation of the irrigation pond, which is located in the flow line of Montezuma Creek and contains contaminated sediments. This remediation and repair to the dam outlet works also is included in this removal action design. When the remediation of Montezuma Creek is complete, the pond will be inspected to determine if dredging is required. At the conclusion of the Millsite remediation, the irrigation pond will be dredged and verified to the 35- μ R/hr alternative action level. Because cultivated fields are adjacent to the OU III boundary, the owners have requested that vehicular traffic be minimized along the field edges.

Table 1. Upper Montezuma Creek Quantities

Quantities	Total Properties	Property MP-00951-VL	Property MP-01084-VL	Property MP-00990-CS	Property MG-01033-VL	Property MG-01026-VL
Total Area (acres)	321.72	28.73	60.00	96.89	80.16	55.94
OU III Boundary Area (acres)	29.73	2.07	3.42	10.32	12.22	1.70
Contaminated Area in Excess of 40 CFR 192 (ft ²)	725,141 (16.7 acres)	76,324 (1.8 acres)	82,495 (1.9 acres)	240,017 (5.5 acres)	279,500 (6.4 acres)	46,805 (1.1 acre)
Contaminated Area in Excess of 35 μ R/hr (ft ²)	*190,162 (4.4 acres)	1,334 (0.03 acres)	20,054 (0.5 acres)	63,235 (1.4 acres)	*101,197 (2.3 acres)	*4,342 (0.1 acre)
	**156,447 (3.6 acres)				**71,824 (1.7 acres)	**0
Contaminated Volume in Excess of 35 μ R/hr (yd ³)	*7,428	25	555	2,420	*4,348	*80
	**6,175				**3,175	**0

Key: ft² = square foot (feet)
 μ R/hr = microrentgens per hour
 yd³ = cubic yard(s)

Note: Areas and volumes shown are based on radiological assessments.

*Indicates the total contaminated area/volume exceeding 35 μ R/hr.

**Indicates only the contaminated area/volume exceeding 35 μ R/hr that will be removed.

Properties MP-00990-CS, MG-01033-VL, and MG-01026-VL are owned by the same property owners who live in Colorado. There is a residence and commercial buildings located on MP-00990-CS along Clayhill Drive north of Montezuma Creek, but they are not being used. The property owners have no concerns in the planned removal action at their properties.

5.0 Design Considerations

In order to minimize environmental damage to areas not requiring excavation, the Contractor will delineate haul routes, creek crossings, and access routes to all deposits and work areas.

Removal of contaminated material from within the creek channel will be required at the east end of MG-00990-CS and MG-01033-VL. A creek diversion will be constructed to accommodate this removal by piping the creek around these areas and reentering the creek downstream of a remnant beaver pond located at the east end of MG-01033-VL (survey grid E30570). The beaver pond is currently silted full and will be dredged while the creek is rerouted around it. Dredging will be limited to the apparent size of the pond prior to dredging, as shown on Sheet 13 of 14 of the design drawings. The pond design depth is 2 ft to allow sediment retention volume (440 to 1,040 yd³) but shallow enough to minimize a safety hazard. The beaver pond will act as a temporary settling pond during the removal action to mitigate the transport of contaminated sediments during removal action. This is achieved by placing two rows of straw bales at the pond outlet to act as a preliminary sediment filter. A silt fence will be placed on the

downstream side of the straw bales to provide a secondary filtration. Material specifications for the silt fence requires an apparent opening size of No. 20 U.S. sieve (0.0331 inch); therefore, it is anticipated that sediments larger than this size will be retained in the beaver pond. After the beaver pond is dredged, the stream will be rerouted back into the beaver pond. Upon completion of the removal action, the beaver pond will be inspected to determine if it has silted enough to require dredging. The diversion pipe will be removed after pond dredging is completed but the pond will be left in place and will serve as a settling pond during remediation of the creek on the Millsite. After DOE remediates the Millsite, the settling pond will be remediated and verified to the 35- μ R/hr alternative action level.

The creek diversion will commence at approximately easterly coordinates E 28600 to approximately E 30500. Flow will be routed through an 18-inch-diameter plastic irrigation pipeline, approximately 2,100 ft long, designed to accommodate normal, historic flow rates for the designated construction time period (June through December). Normal historic flow rates in the creek were used to obtain pipe sizes, as opposed to a 25-year storm event, which would require pipe diameters in excess of 6-ft. The pipeline will carry the mean historic flow of 1.0 cubic feet per second (cfs), flowing approximately 3 to 4 inches deep. Full-flow capacity of the pipe, which is approximately 12 cfs, would be exceeded only during major storm events.

A small earthen embankment, 3 ft high with an approximate crest elevation of 6,701.0 ft, will be constructed across Montezuma Creek at the diversion inlet. A spillway will be placed in the diversion embankment at an elevation of 6700.5 ft. The pipeline will be below grade for approximately the first 1,000 ft past the embankment until it daylight. For the remaining distance, the pipe will be placed directly on grade. A junction box will be constructed on the pipeline alignment above the beaver pond sediment basin to allow creek flow to be diverted around the pond while the pond is being dredged and when pond maintenance is required. In the event of a storm event that exceeds the maximum flow capacity of the pipeline, water will flow through the spillway, eroding the dam and causing a breach. A breach in the dam will cause erosion and transportation of sediments in the creek channel; however, the downstream beaver pond will mitigate sediment transport downstream of the beaver pond basin. If the dam is breached, it will be reconstructed after the storm event so the creek can be rerouted before excavation in the stream recommences.

This removal action is based on an alternative action level that significantly reduces the amount of area requiring disturbance. Access to contamination deposits is restricted to designated routes, as shown on Sheets 3 through 8 of the design drawings, which are located to minimize damage. Creek crossings are limited to existing crossings and, in areas where removal is required on both sides of the creek. This minimizes the environmental damage and reduces the amount of bank reconstruction.

It is anticipated that groundwater will be encountered while excavating near the stream channel. Groundwater control will be accomplished by pumping out the excavations into a "pumped-silt control system," which then discharges directly into the creek channel. The "pumped-silt control system" is a fabric filter bag that allows dirty water to be pumped into it and collects sand, silt, and fines as the clean water filters out from all sides. Once the bags are filled with silt, they will be hauled and disposed at the Millsite.

5.1 ARAR Compliance

Appendix B presents an evaluation of ARARs for this removal action. The following describes how this design complies with the ARARs for the Upper Montezuma Creek excavation.

Uranium Mill Tailings Radiation Control Act

The areas delineated for removal will be excavated and verified to the 40 CFR 192 Ra-226 cleanup standards of 5/15 pCi/g for open land. The contaminated material remaining will have supplemental standards applied based on the criterion in 40 CFR 192.21(b): remediation to 5/15 pCi/g Ra-226 in Upper Montezuma Creek would cause environmental harm that is excessive compared to the health benefits of remediation.

Archaeological and Historical Preservation Act

A recent archaeological survey identified that the removal action will have no impact on any known archaeological site.

Fish and Wildlife Coordination Act

DOE has prepared a *Biological Assessment of Monticello Mill Tailings Site Remedial Activities* (draft, January 1998) and has requested a formal consultation with the U.S. Fish and Wildlife Service (USFWS). This removal action is based on an alternative action level that significantly reduces the amount of area requiring disturbance. In addition, access to the contamination deposits is restricted to designated routes, which are located to minimize damage. Creek crossings are limited and, whenever possible, are located in areas where removal is required on both sides of the creek. The reclamation plan requires revegetation of riparian areas as well as reestablishment of wetland areas.

Endangered Species Act

DOE has prepared the *Biological Assessment of Monticello Mill Tailing Site Remedial Activities* (draft, January 1998), which discusses the effects of OU III activities on threatened and endangered species, and has submitted this document of the USFWS for a biological opinion. Although this removal action may temporarily affect flows within Montezuma Creek, flows will not be hindered. Temporary creek reroutes or pipe diversions are used to maintain flows throughout remediation.

Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands)

This removal action is based on an alternative action level that significantly reduces the amount of area requiring disturbance. In addition, access to the contamination deposits is restricted to designated routes, which are located to minimize damage. Creek crossings are limited and, wherever possible, are located in areas where removal is required on both sides of the creek. The reclamation plan requires revegetation of riparian areas as well as the reestablishment of wetland areas.

National Environmental Policy Act

In compliance with the National Environmental Policy Act (NEPA) requirements, environmental impacts associated with this removal action evaluated in the Remedial Investigation (DOE 1998) and Alternative Analysis (DOE 1998) reports. These reports provide environmental information concerning soil and sediment cleanup in OU III, evaluate each of the proposed alternatives, and identify the selected remedy. In keeping with the findings of the Alternatives Analysis report, this removal action identifies the engineering and environmental controls that will be implemented to mitigate and reduce impacts on the environment.

Drinking Water Rules, Water Quality, and Groundwater Quality Protection

This removal action is based on an alternative action level that significantly reduces the area requiring disturbance, which reduces the amount of potential water quality impacts. In order to mitigate a temporary discharge of contaminants (i.e., sediment) to Montezuma Creek, engineering controls such as the construction of sediment control ponds, installation of straw bales and silt fences, and filtration of sediment laden waters (using sediment pillows, "dirt bags," etc.) are included in the removal action.

Utah Pollutant Discharge Elimination System (UPDES)

The total disturbed area, including haul roads, will exceed 5 acres; therefore, a Stormwater Pollution Prevention Plan will be developed for this project. The requirements stipulated in the plan will prevent construction-water runoff from the site.

Dredge or Fill Requirements (Section 404)

A Joint Permit Application Form U.S. Army Corps of Engineers—for Sections 404 and 10 Utah State Engineer's Office—for Natural Stream Channels (included in Section B.4.0) has been prepared for activities that will alter the stream channel in the Upper Montezuma Creek area; however, the application will not be submitted to the State Engineer. It is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met.

Air Quality

The Monticello General Construction Specifications are to be used for this project. These specifications require that measures shall be implemented to eliminate any visible dust. Dust control may be implemented through the use of dust suppressants, including water.

Corrective Action Cleanup Standards Policy for CERCLA and Underground Storage Tank Sites

Implementation of this removal action is based on a CERCLA risk assessment and meets all ARARs, which constitutes compliance with this requirement.

Radiation Control

Regulations stated in 29 CFR 1910 and 29 CFR 1926 regarding removal of the uranium mill tailings will be enforced during this removal action. In addition, U.S. Department of Transportation regulations governing the transportation of hazardous materials will be enforced.

Water Rights

Surface water will be impounded at the irrigation pond and the beaver pond during this removal action. An *Application to Appropriate Water* in the State of Utah (included in Section B.5.0) has been prepared to account for the evaporative loss that will occur from the beaver pond during the temporary impoundment of Montezuma Creek at this location; however, this application will not be submitted to the State Engineer. It is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met. In addition, an *Application for a Dam Not Requiring Submission of Formal Plans* is required for any dam meeting the exclusion under Section 73-5a-202. This application also has been prepared and is included in Section B.6.0; however, this application will not be submitted

to the State Engineer. It is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met.

An *Application to Appropriate Water* is not required for the irrigation pond because water has been previously impounded and used at this location, and the water rights for this use are held by the current land owners.

6.0 Quantities/Cost Estimate

Past experience on similar projects has shown that actual excavated contaminated materials can exceed the radiologically assessed quantities by an average of 70 percent. This increase has been largely due to chasing contamination laterally from previously identified surface contamination. Anticipated additional quantities for this design (50 percent) are significantly less than the average increase as a result of the negotiated cleanup design, which calls for vertically excavating below the specified 35 $\mu\text{R/hr}$ areas with no lateral chasing of contamination. However, it is expected that there will be small variations in the actual depth of contamination encountered during remediation compared to the depths assessed during the field investigation and data interpretation that exceed 40 CFR 192 standards. The difference between actual depth and assessed depths results in additional volume (quantities) of contaminated material being removed during excavation.

Table 2 summarizes the quantities of material that are expected to be excavated during implementation of this design package. The total estimated volume of contaminated material to be removed from the property as a result of the removal action is 13,537 yd^3 (21,698 tons).

Table 2. Area/Volume Summary—Upper Montezuma Creek

<u>Assessed Quantities (35 $\mu\text{R/hr}$):</u>			
Contaminated	6,175 yd^3	9,907 tons	156,447 ft^2
Uncontaminated	0 yd^3	0 tons	0 ft^2
Subtotals	6,175 yd^3	9,907 tons	156,447 ft^2
<u>Anticipated Additional Quantities:</u>			
Contaminated	3,088 yd^3	4,940 tons	
Uncontaminated	0 yd^3	0 tons	
Subtotals:	3,088 yd^3	4,940 tons	
<u>Non-35 $\mu\text{R/hr}$ Areas:</u>			
Irrigation Pond	2,874 yd^3	4,611 tons	27,639 ft^2
Beaver/Settling Pond	1,400 yd^3	2,240 tons	12,044 ft^2
Subtotals:	4,274 yd^3	6,851 tons	39,683 ft^2
Project Totals:	13,537 yd^3	21,698 tons	196,130 ft^2
Key: ft^2 = square foot (feet) yd^3 = cubic yard(s)			

Table 3 summarizes the cost estimate for implementation of this design. The total estimated project cost is \$600,000.

Table 3. Construction Cost Estimate

No.	Operation	Initial Quantity	Unit of Measure	Unit Price	Total Cost
1	Mobilization/Demobilization	1	LS	56,646.94	56,647
2	Demolition/Brush Removal/Burning	1	LS	3,701.19	3,701
3	Excavate Contaminated Material—Assessed Area	6,175	yd ³	14.67	90,587
4	Dredge Contaminated Material—Irrigation Pond	2,875	yd ³	11.28	32,430
5	Dredge Contaminated Material—Sediment Pond	1,400	yd ³	11.28	15,792
6	Hand-Excavate Contaminated Material	10	yd ³	78.54	785
7	Excavate Contamination—Well Head Crib	1	LS	402.61	403
8	Common Borrow Backfill—Assessed Area	2,377	yd ³	11.74	27,906
9	Topsoil Backfill—Assessed Area	2,898	yd ³	22.49	65,176
10	Stream Channel Backfill	900	yd ³	20.45	18,405
11	Sediment Pond Silt Control	1	LS	428.60	429
12	Montezuma Creek Diversion Dam	1	LS	1,115.85	1,116
13	Montezuma Creek Diversion Pipe Excavation/Backfill	625	yd ³	5.78	3,613
14	Place Montezuma Creek Diversion Pipe	2,100	LF	22.93	48,153
15	Montezuma Creek Diversion—Junction Box	1	LS	1,508.44	1,508
16	Divert Montezuma Creek—Irrigation Pond	1	LS	6,071.79	6,072
17	Place Compacted 6-in. Pitrun	917	yd ³	26.51	24,310
18	Place Compacted 4-in. Roadbase	203	yd ³	55.81	11,329
19	Riprap—Hand Placed	25	yd ³	70.85	1,771
20	Riprap—Loose Placed	70	yd ³	34.06	2,384
21	Riprap—Loose Placed Dam Outlet Control	50	yd ³	34.06	1,703
22	Dam Outlet Control	1	LS	2,197.20	2,197
23	Revegetation—Wetland	2	acre	4,355.59	8,189
24	Revegetation—Riparian/Uplands	3	acre	6,867.25	21,975
25	Erosion-Control Matting Type B	9,099	yd ²	1.87	17,015
26	Erosion-Control Matting Type D	13,552	yd ²	2.29	31,034
27	Wetlands Fencing	7,510	LF	3.28	24,633
				Subtotal	519,263
Additional Quantities					
28	Common Borrow Backfill	3,088	yd ³	11.74	36,253
29	Excavation	3,088	yd ³	14.63	45,177
				SUBTOTAL:	81,431
				TOTAL:	\$ 600,694
				TOTAL ESTIMATED PROJECT COST:	\$ 600,000

Key: LS = lump sum, yd² = square yard(s) yd³ = cubic yard(s)

7.0 Removal Action Verification

Because of the DOE, EPA, and State of Utah agreement on the cleanup alternative for Upper Montezuma Creek, excavation will progress vertically in each contaminated deposit area until verification indicates that 40 CFR 192 cleanup standards have been achieved. Contaminated material will not be chased laterally for any deposit. During the removal action, standard verification procedures, in accordance with Section 3.7.3, "Standard Verification Method," of the *Field Services Procedures Manual* (Manual MAC-3000), will be used to verify that cleanup standards have been met.

Appendix A

Radiological Assessment

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A.1.0 Introduction

This radiological assessment report involves five properties that comprise the Upper Montezuma Creek area of Monticello Mill Tailings Site (MMTS) project Operable Unit (OU) III. These properties are DOE ID Numbers MG-00951-VL (County Plat Number 33S24E317200), MG-01084-VL (County Plat Number 33S24E326000), both owned by Bryan E. and Sherrill Bowring, and MG-00990-CS (County Plat Number 33S24E324800), MG-01026-VL (County Plat Number 34S24E042400), and MG-01033-VL (County Plat Number 34S24E050000), owned by Sutherland Brothers, Inc. These properties are located east of the Monticello Millsite and are primarily used for agricultural.

Radiological data were collected from 1994 through 1997 following procedures described in the

- draft *Monticello Mill Tailings Site, Operable Unit III, Remedial Investigation/Feasibility Study, Field Sampling Plan* (July 1994, March 1995);
- *Monticello Mill Tailings Site, Operable Unit III, Focused Work Plan for Confirmatory Soil Sampling* (DOE 1994);
- draft final *Monticello Mill Tailings Site, Operable Unit III, Remedial Investigation/Feasibility Study, Field Sampling Plan* (September 1995); and the
- *Monticello Mill Tailings Site, Operable Unit III, Sampling and Analysis Plan for Additional Characterization of Middle and Lower Montezuma Creek* (April 1996).

These data were evaluated to estimate the extent of contamination from residual radioactive material in excess of the U.S. Environmental Protection Agency (EPA) "Standards for Remedial Action at Inactive Uranium Processing Sites" (40 CFR Part 192) and are presented in this assessment.

The measurement techniques, instrumentation, and procedures used in this radiological assessment are primarily based on protocols developed by the U.S. Department of Energy (DOE) Office of Remedial Action and Waste Technology Technical Measurements Center and on field implementation experience gained from the characterization of millsites and vicinity properties for the Uranium Mill Tailings Remedial Action (UMTRA) Program. Detailed procedures for collecting soil samples and radiological measurements are presented in the MACTEC-ERS *Field Services Procedures Manual*. Detailed analytical procedures are presented in the following WASTREN-GJ Grand Junction Office (GJO) Analytical Laboratory manuals: *Administrative Plan and Quality Control Methods for Analytical Laboratories* and the *Handbook of Analytical and Sample Preparation Methods*, Volumes I through IV.

A.2.0 Background Gamma Exposure Rate and Radium Determinations

The background gamma exposure rate and radium-226 (Ra-226) concentration for the MMTS OU III properties were determined during the radiological characterization conducted by Bendix Field Engineering Corporation in 1984. This study concluded that the average background gamma exposure rate measurement is 15 microroentgens per hour ($\mu\text{R/hr}$) and the background Ra-226 concentration is 1.0 pCi/g.

A.3.0 Gamma Exposure Rate Survey

A ground-level gamma exposure rate survey was completed in April 1994 within the boundary of OU III. Contour intervals selected for the surveys were 18 $\mu\text{R/h}$, 24 $\mu\text{R/h}$, and 97 $\mu\text{R/h}$. In certain areas of interest on the properties, additional gamma exposure-rate readings at ground level and waist level were collected during 1996. These additional readings were required to adequately characterize the area. A 35- $\mu\text{R/h}$ contour line was interpolated from the data collected for the entire Upper Montezuma Creek project. This interpolated gamma line was used in the risk management decision by DOE, EPA, and the State of Utah. It was determined that only areas above the beaver pond would be remediated.

Based on the new areas to be remediated, additional gamma exposure-rate surveys were completed upstream of the beaver pond in November 1997 to define the actual 35- $\mu\text{R/h}$ contour interval. These boundaries were delineated with physical gamma surveys, and located with land survey techniques. These 35- $\mu\text{R/h}$ contour intervals are shown as Area Designations A through HH on Figure 3-1. The original interpolated 35- $\mu\text{R/h}$ contour lines down stream of the beaver ponds (Area Designations II through LL, Figure 3-1, Sheets 2 and 3) are the contour lines from the 1994 and 1996 gamma survey and are shown for reference.

Gamma exposure rate measurements were collected with the Mount Sopris (Model SC-132) and Eberline (Model E-600) scalers with a thallium activated sodium iodide crystal gamma detector. These instruments measure gross gamma in counts per second (cps) and are cross-correlated with a pressurized ionization chamber to determine the correlation factors used to convert the raw cps data to true gamma exposure rates.

Ground-level gamma exposure rates measured on these properties ranged from 11 $\mu\text{R/hr}$ to 103 $\mu\text{R/hr}$. Sheets 1 through 3 of Figure 3-1 are gamma exposure rate contour maps generated with the discrete ground-level readings collected during the 1994, 1996, and 1997 surveys.

A.4.0 Radon/Radon Decay-Product Concentration (RDC) Measurements

EPA RDC guidelines are not applicable, since no habitable structures exist within the OU III boundary of the properties.

A.5.0 In-Situ Radium Measurements and Soil Samples

Sheets 1 through 3 of Figure 5-1 show the locations of measurements made; the related radium data are presented in Tables 5-1a and 5-1b. Ra-226 concentrations, as determined by the methods used in these characterizations, range from 1.0 pCi/g to 178.0 pCi/g. Delta-gamma scintillometers, borehole logging, and soil sampling were the methods used to characterize these properties.

A.5.1 Delta-Gamma Measurements

BFEC (Model EL-0018A) delta-gamma scintillometers were used to estimate the in-situ Ra-226 concentrations and to differentiate between areas of secondary gamma radiation (shine) and areas of contamination. These instruments measure the difference in count rate between shielded and unshielded readings at a discrete sample location. The readings were reduced to pCi/g equivalent Ra-226 by applying conversion factors determined during calibration.

A.5.2 Borehole Logging

Boreholes were drilled and logged in overbank areas with elevated surface contamination, depositional areas, and areas determined by the regulators to be of interest, to determine the depth of contamination present. Boreholes also were drilled and logged in areas with no surface contamination to confirm the lack of contamination at depth. All holes were drilled with either a portable gasoline-powered auger or all terrain vehicle-mounted auger, both using bits measuring 4½ inches in diameter. Eberline (Models PRS-1 and ESP-1) scalars equipped with Model SPA-3 gamma-scintillation detectors were used to log the holes in 6-inch-depth intervals. The gamma counts were accumulated for 30 seconds at each interval. These readings were reduced to pCi/g equivalent Ra-226 by applying conversion factors determined during calibration.

Total-count logging was performed with a Geoprobe Hydraulic Hammer-Drill (Geoprobe). The Geoprobe is a vehicle-mounted, hydraulically operated hammer-drill capable of pressing hollow rods into the ground. Eberline (Model ESP-1) scalars equipped with Bicron Model 162000 pipe monitor gamma ray detectors were used to log the holes in 6-inch-depth intervals. The gamma counts were accumulated for 60 seconds at each interval through the hollow rods. These readings were reduced to pCi/g equivalent Ra-226 by applying conversion and attenuation factors determined during calibration.

A.5.3 Soil Samples

One hundred fifty-four soil samples were collected and submitted to the GJO Analytical Laboratory for Ra-226 activity analysis by gamma spectrometry. For prompt radium concentration determinations, four soil samples were analyzed by the Opposed Crystal System.

A.6.0 Estimated Extent of Contamination

All radiological data available for these properties were reviewed and evaluated according to guidelines described in the MACTEC-ERS *Field Services Procedures Manual*. The results of this evaluation indicate that Ra-226 contamination is present in discontinuous, elongated deposits adjacent to Montezuma Creek. The depth of Ra-226 contamination is generally less than 36 inches, but does extend to 72 inches in some places.

Sheets 1 through 3 of Figure 6-1 are isopleth maps showing the estimated boundaries and depths of contamination determined for each 6-inch-thick soil layer for the first 12 inches. Contamination deposits deeper than 12 inches are contoured in 12-inch-thick intervals. Table 5-1a shows the sample locations, Ra-226 results, and gamma exposure rates for each location. Laboratory sample analysis results are shown in Table 5-1b.

A.7.0 Alternative Cleanup Recommendations

Remove contamination above the beaver pond in Area Designations A through HH that display surface gamma exposure rates exceeding 35 μ R/h as shown in Figure 3-1, Sheets 1 through 3, to below 40 CFR 192 standards. Area Designations II through LL below the beaver ponds, in Figure 3-1, Sheets 2 and 3, should not be removed.

These properties contain deposits of uranium mill tailings that exceed 130.0 pCi/g of Ra-226. U.S. Department of Transportation (DOT) requirements for transporting radioactive material (RAM) when Part 'B' properties are defined by field assessment must be followed during the removal action.

These requirements include two options: (1) transport the material in placarded trucks under DOT Exemption E-10594, or (2) blend with other material (RAM) to produce an average concentration that is less than the cutoff activity (see *Field Services Procedures Manual* [MAC-3000]).

Standard verification procedures may be used for these properties.

A.8.0 Commingled Waste Investigation

Commingled (suspect hazardous material mixed with radioactive material) waste investigations were not performed on these properties.

Table 5-1a. 1996 Soil and Sediment Field Radiological Measurements: Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
22SD96-02 0	0	TC	5.4	18	21	R2-96 30	30	TC	2.8		
22SD96-02 6	6	TC	12.5			R2-96 36	36	TC	2.9		
22SD96-02 12	12	TC	18.0			R2-96 42	42	TC	2.9		
22SD96-02 18	18	TC	14.6			R2-96 48	48	TC	2.8		
22SD96-02 24	24	TC	12.5								
22SD96-02 30	30	TC	6.5			R3-96 0	0	TC	2.5	16	16
						R3-96 0	0	DS	<1.0		
22SD96-03 0	0	TC	2.2	14	16	R3-96 6	6	TC	2.9		
22SD96-03 6	6	TC	4.9			R3-96 12	12	TC	2.9		
22SD96-03 12	12	TC	8.1			R3-96 18	18	TC	2.9		
22SD96-03 18	18	TC	8.3			R3-96 24	24	TC	2.8		
22SD96-03 24	24	TC	11.0			R3-96 30	30	TC	2.8		
22SD96-03 30	30	TC	13.0			R3-96 36	36	TC	2.8		
22SD96-03 36	36	TC	10.0								
22SD96-03 42	42	TC	8.0			R4-96 0	0	TC	6.8	32	27
22SD96-03 48	48	TC	8.0			R4-96 0	0	DS	14.0		
						R4-96 6	6	TC	6.8		
23SD96-02 0	0	TC	2.8	32	21	R4-96 12	12	TC	3.1		
23SD96-02 6	6	TC	2.3			R4-96 18	18	TC	3.4		
23SD96-02 12	12	TC	8.4			R4-96 24	24	TC	2.7		
23SD96-02 18	18	TC	8.7			R4-96 27	27	TC	2.9		
23SD96-02 24	24	TC	6.9								
23SD96-02 30	30	TC	8.6			R5-96 0	0	TC	13.3	51	42
23SD96-02 36	36	TC	11.0			R5-96 0	0	DS	28.4		
23SD96-02 42	42	TC	12.1			R5-96 6	6	TC	26.2		
23SD96-02 48	48	TC	10.8			R5-96 12	12	TC	50.9		
						R5-96 18	18	TC	15.3		
23SD96-05 0	0	TC	3.0	21	17	R5-96 24	24	TC	5.8		
23SD96-05 6	6	TC	1.6			R5-96 30	30	TC	6.9		
23SD96-05 12	12	TC	2.3								
23SD96-05 18	18	TC	2.7			R6-96 0	0	TC	6.3	29	27
23SD96-05 24	24	TC	3.0			R6-96 0	0	DS	9.0		
23SD96-05 30	30	TC	3.5			R6-96 6	6	TC	8.7		
23SD96-05 36	36	TC	2.7			R6-96 12	12	TC	3.8		
23SD96-05 42	42	TC	2.6			R6-96 18	18	TC	4.1		
						R6-96 24	24	TC	4.0		
R1-96 0	0	TC	7.6	25	23						
R1-96 0	0	DS	8.4			R7-96 0	0	TC	37.5	81	58
R1-96 6	6	TC	12.9			R7-96 0	0	DS	79.1		
R1-96 12	12	TC	51.5			R7-96 6	6	TC	104.4		
R1-96 18	18	TC	70.7			R7-96 12	12	TC	86.6		
R1-96 24	24	TC	50.2			R7-96 18	18	TC	10.8		
R1-96 30	30	TC	.9			R7-96 24	24	TC	3.5		
R1-96 36	36	TC	7.0			R7-96 30	30	TC	4.8		
R2-96 0	0	TC	2.1	14.3	14.3	R8-96 0	0	TC	6.6	27	25
R2-96 0	0	DS	<1.0			R8-96 0	0	DS	10.9		
R2-96 6	6	TC	2.2			R8-96 6	6	TC	12.4		
R2-96 12	12	TC	2.4			R8-96 12	12	TC	10.1		
R2-96 18	18	TC	2.8			R8-96 18	18	TC	3.3		
R2-96 24	24	TC	2.8			R8-96 24	24	TC	4.5		

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil Field Radiological Measurements; Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R9-96	0	TC	2.6	15	16	R14-96	18	TC	3.4		
R9-96	0	DS	<1.0			R14-96	24	TC	3.2		
R9-96	6	TC	2.7			R14-96	30	TC	3.2		
R9-96	12	TC	2.9			R14-96	36	TC	3.1		
R9-96	18	TC	2.7								
R9-96	24	TC	2.6			R15-96	0	TC	3.6	21	18
R9-96	30	TC	2.6			R15-96	0	DS	6.9		
R9-96	36	TC	2.7			R15-96	6	TC	3.9		
R9-96	42	TC	2.7			R15-96	12	TC	2.9		
R9-96	48	TC	2.7			R15-96	18	TC	2.6		
						R15-96	24	TC	2.6		
						R15-96	30	TC	2.6		
R10-96	0	TC	5.5	29	25						
R10-96	0	DS	13.5			R16-96	0	TC	14.2	44	36
R10-96	6	TC	8.4			R16-96	0	DS	23.7		
R10-96	12	TC	3.6			R16-96	6	TC	34.4		
R10-96	18	TC	5.0			R16-96	12	TC	3.7		
R10-96	24	TC	3.5			R16-96	18	TC	3.5		
R10-96	30	TC	3.2			R16-96	24	TC	3.3		
						R16-96	30	TC	3.0		
R11-96	0	TC	29.6	88	58	R16-96	36	TC	3.2		
R11-96	0	DS	83.4								
R11-96	6	TC	108.6			R17-96	0	TC	5.9	29	25
R11-96	12	TC	44.4			R17-96	0	DS	20.7		
R11-96	18	TC	3.4			R17-96	6	TC	7.5		
R11-96	24	TC	2.3			R17-96	12	TC	4.5		
R11-96	30	TC	4.2			R17-96	18	TC	3.5		
						R17-96	24	TC	3.4		
R12-96	0	TC	4.3	30	21	R17-96	30	TC	3.2		
R12-96	0	DS	5.9			R17-96	36	TC	3.8		
R12-96	6	TC	6.0			R17-96	42	TC	3.7		
R12-96	12	TC	4.1			R17-96	48	TC	3.6		
R12-96	18	TC	3.3			R17-96	54	TC	3.4		
R12-96	24	TC	3.3			R17-96	60	TC	2.9		
R12-96	30	TC	3.0			R17-96	66	TC	3.2		
R12-96	36	TC	3.4								
R12-96	42	TC	2.9								
						R39-96	0	TC	5.2		
R13-96	0	TC	4.1	23	19	R39-96	0	DS	5.0		
R13-96	0	DS	5.5			R39-96	6	TC	7.7		
R13-96	6	TC	8.0			R39-96	12	TC	11.0		
R13-96	12	TC	4.2			R39-96	18	TC	9.1		
R13-96	18	TC	3.4			R39-96	24	TC	6.8		
R13-96	24	TC	3.3			R39-96	30	TC	9.7		
R13-96	30	TC	3.3			R39-96	36	TC	12.0		
R13-96	36	TC	3.0			R39-96	42	TC	12.1		
R13-96	42	TC	3.1			R39-96	48	TC	12.1		
						R39-96	54	TC	8.3		
R14-96	0	TC	2.6	16	16	R39-96	60	TC	5.2		
R14-96	0	DS	1.1			R39-96	66	TC	5.5		
R14-96	6	TC	3.1								

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil and Sediment Field Radiological Measurements
Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R14-96	12	TC	3.2			R92-96	0	TC	15.2	55	44
R92-96	0	DS	36.3			R97-96	36	TC	3.7		
R92-96	6	TC	38.0								
R92-96	12	TC	46.4			R98-96	0	TC	2.6	14	15
R92-96	18	TC	83.1			R98-96	0	DS	1.3		
R92-96	24	TC	93.7			R98-96	6	TC	3.1		
R92-96	30	TC	15.1			R98-96	12	TC	3.7		
R92-96	36	TC	13.2			R98-96	18	TC	3.4		
						R98-96	24	TC	3.3		
R93-96	0	TC	8.5	36	30	R98-96	30	TC	3.6		
R93-96	0	DS	18.2			R98-96	36	TC	3.7		
R93-96	6	TC	17.0								
R93-96	12	TC	12.5			R99-96	0	TC	26.9	96	73
R93-96	18	TC	5.4			R99-96	0	DS	64.1		
R93-96	24	TC	4.8			R99-96	6	TC	64.2		
R93-96	30	TC	3.3			R99-96	12	TC	89.5		
R93-96	36	TC	3.4			R99-96	18	TC	71.0		
						R99-96	24	TC	25.0		
R94-96	0	TC	2.9	16	17	R99-96	30	TC	10.4		
R94-96	0	DS	1.6			R99-96	36	TC	9.5		
R94-96	6	TC	3.3			R99-96	42	TC	8.6		
R94-96	12	TC	3.8								
R94-96	18	TC	4.0			R100-96	0	TC	13.3	51	51
R94-96	24	TC	3.9			R100-96	0	DS	32.8		
R94-96	30	TC	3.9			R100-96	6	TC	31.5		
R94-96	36	TC	3.8			R100-96	12	TC	25.1		
						R100-96	18	TC	7.2		
R95-96	0	TC	18.7	40	34	R100-96	24	TC	5.5		
R95-96	0	DS	18.2			R100-96	30	TC	4.0		
R95-96	6	TC	44.8			R100-96	36	TC	4.9		
R95-96	12	TC	53.5								
R95-96	18	TC	13.1			R101-96	0	TC	2.8	17	16
R95-96	24	TC	4.9			R101-96	0	DS	1.6		
R95-96	30	TC	2.7			R101-96	6	TC	4.0		
R95-96	36	TC	4.2			R101-96	12	TC	4.0		
						R101-96	18	TC	4.3		
R96-96	0	TC	2.5	15	15	R101-96	24	TC	4.1		
R96-96	0	DS	<1.0			R101-96	30	TC	3.9		
R96-96	6	TC	3.2			R101-96	36	TC	3.6		
R96-96	12	TC	3.6								
R96-96	18	TC	3.3			R102-96	0	TC	3.1	18	18
R96-96	24	TC	3.3			R102-96	0	DS	1.7		
R96-96	30	TC	3.3			R102-96	6	TC	3.7		
R96-96	36	TC	3.3			R102-96	12	TC	4.1		
						R102-96	18	TC	3.6		
R97-96	0	TC	4.2	21	22	R102-96	24	TC	3.8		
R97-96	0	DS	5.1			R102-96	30	TC	3.5		
R97-96	6	TC	6.6			R102-96	36	TC	3.4		
R97-96	12	TC	5.9								

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil Field Radiological Measurements; Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R97-96	18	TC	4.0			R103-96	0	TC	22.3	73	66
R97-96	24	TC	4.2			R103-96	0	DS	49.6		
R97-96	30	TC	3.9			R103-96	6	TC	42.7		
R103-96	12	TC	38.5			R109-96	6	TC	21.0		
R103-96	18	TC	12.0			R109-96	12	TC	33.2		
R103-96	24	TC	8.3			R109-96	18	TC	25.2		
R103-96	30	TC	7.1			R109-96	24	TC	21.0		
R103-96	36	TC	7.0			R109-96	30	TC	22.3		
						R109-96	36	TC	7.9		
R104-96	0	TC	4.3	25	23	R110-96	0	TC	4.3	25	23
R104-96	0	DS	5.4			R110-96	0	DS	6.7		
R104-96	6	TC	6.1			R110-96	6	TC	5.7		
R104-96	12	TC	6.1			R110-96	12	TC	8.2		
R104-96	18	TC	4.9			R110-96	18	TC	10.2		
R104-96	24	TC	4.4			R110-96	24	TC	10.8		
R104-96	30	TC	4.2			R110-96	30	TC	19.9		
R104-96	36	TC	3.8			R110-96	36	TC	15.9		
R105-96	0	TC	2.1	17	16	R110-96	42	TC	8.2		
R105-96	0-6	OC	2.8			R110-96	48	TC	7.1		
R105-96	0	DS	2.0								
R105-96	6	TC	3.4			R111-96	0	TC	36.5	126	103
R105-96	12	TC	3.1			R111-96	0	DS	81.6		
R105-96	18	TC	2.9			R111-96	6	TC	88.6		
R105-96	24	TC	3.0			R111-96	12	TC	107.9		
R105-96	30	TC	3.4			R111-96	18	TC	61.7		
						R111-96	24	TC	26.6		
R106-96	0	TC	23.1	73	55	R111-96	30	TC	13.1		
R106-96	0	DS	47.9			R111-96	36	TC	9.8		
R106-96	6	TC	61.6								
R106-96	12	TC	97.5			R112-96	0	TC	37.6	133	103
R106-96	18	TC	29.6			R112-96	0	DS	95.8		
R106-96	24	TC	13.3			R112-96	6	TC	83.6		
R106-96	30	TC	9.3			R112-96	12	TC	80.8		
						R112-96	18	TC	29.3		
R107-96	0	TC	21.6	66	44	R112-96	24	TC	18.7		
R107-96	0	DS	44.8			R112-96	30	TC	13.1		
R107-96	6	TC	56.6			R112-96	36	TC	7.1		
R107-96	12	TC	110.1								
R107-96	18	TC	39.2			R113-96	0	TC	16.1	81	55
R107-96	24	TC	8.3			R113-96	0	DS	71.3		
R107-96	30	TC	3.2			R113-96	6	TC	23.3		
R107-96	36	TC	4.3			R113-96	12	TC	13.3		
						R113-96	18	TC	12.4		
R108-96	0	TC	2.3	17	15	R113-96	24	TC	12.5		
R108-96	0	DS	<1.0			R113-96	30	TC	12.5		
R108-96	6	TC	2.4			R113-96	36	TC	5.5		
R108-96	12	TC	2.6								
R108-96	18	TC	2.8			R114-96	0	TC	31.0	96	81
R108-96	24	TC	2.5			R114-96	0	DS	70.4		

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil and Sediment Field Radiological Measurements
Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R108-96	30	TC	2.7			R114-96	6	TC	68.2		
R109-96	0	TC	9.9	32	30	R114-96	12	TC	81.6		
R109-96	0	DS	15.5			R114-96	18	TC	34.6		
R114-96	30	TC	7.8			R114-96	24	TC	6.9		
R114-96	36	TC	6.3			R120-96	30	TC	3.4		
R115-96	0	TC	18.5	77	55	R120-96	36	TC	3.1		
R115-96	0	DS	54.6			R121-96	0	TC	5.0	25	23
R115-96	6	TC	28.6			R121-96	0	DS	7.4		
R115-96	12	TC	19.2			R121-96	6	TC	7.6		
R115-96	18	TC	9.9			R121-96	12	TC	5.2		
R115-96	24	TC	6.2			R121-96	18	TC	5.0		
R115-96	30	TC	5.9			R121-96	24	TC	4.9		
R115-96	36	TC	5.7			R121-96	30	TC	4.6		
R116-96	0	TC				R121-96	36	TC	4.2		
17	17	R122-96	0	TC	4.3	23	19				
R116-96	0	DS	1.3			R122-96	0	DS	6.6		
R116-96	6	TC	3.1			R122-96	6	TC	8.6		
R116-96	12	TC	3.4			R122-96	12	TC	14.6		
R116-96	18	TC	2.7			R122-96	18	TC	4.2		
R116-96	24	TC	2.8			R122-96	24	TC	5.4		
R117-96	0	TC	20.7	81	58	R122-96	30	TC	4.5		
R117-96	0	DS	40.8			R122-96	36	TC	4.4		
R117-96	6	TC	70.9			R123-96	0	TC	6.6	29	23
R117-96	12	TC	94.9			R123-96	0	DS	12.7		
R117-96	18	TC	11.5			R123-96	6	TC	15.4		
R117-96	24	TC	6.5			R123-96	12	TC	22.9		
R117-96	30	TC	4.7			R123-96	18	TC	8.9		
R118-96	0	TC	2.6	16	16	R123-96	24	TC	5.8		
R118-96	0	DS	<1.0			R123-96	30	TC	6.2		
R118-96	6	TC	3.4			R123-96	36	TC	7.2		
R118-96	12	TC	3.5			R123-96	42	TC	7.0		
R118-96	18	TC	3.4			R123-96	48	TC	6.7		
R118-96	24	TC	3.4			R123-96	54	TC	6.2		
R118-96	30	TC	3.3			R123-96	60	TC	4.5		
R118-96	36	TC	3.2			R123-96	66	TC	4.7		
R119-96	0	TC	21.5	47	36	R124-96	0	TC	1.8	15	15
R119-96	0	DS	22.0			R124-96	0	DS	<1.0		
R119-96	6	TC	27.7			R124-96	6	TC	3.1		
R119-96	12	TC	89.5			R124-96	12	TC	3.2		
R119-96	18	TC	82.0			R124-96	18	TC	3.5		
R119-96	24	TC	4.5			R124-96	24	TC	1.1		
R119-96	30	TC	2.6			R124-96	30	TC	3.5		
R119-96	36	TC	5.8			R124-96	36	TC	3.1		

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil Field Radiological Measurements: Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R120-96	0	TC	11.4	44	27	R125-96	0	TC	6.1	36	29
R120-96	0	DS	25.9			R125-96	0	DS	28.2		
R120-96	6	TC	40.2			R125-96	6	TC	25.8		
R120-96	12	TC	15.9			R125-96	12	TC	36.3		
R120-96	18	TC	7.5			R125-96	18	TC	2.8		
R120-96	24	TC	4.6			R125-96	24	TC	2.8		
R125-96	36	TC	2.6			R125-96	30	TC	2.6		
R125-96	42	TC	2.6			R130-96	18	TC	5.7		
R125-96	48	TC	2.0			R130-96	24	TC	5.0		
R125-96	54	TC	2.7			R130-96	30	TC	4.1		
R125-96	60	TC	2.1			R130-96	36	TC	3.5		
R125-96	66	TC	2.0			R131-96	0	TC	3.8	20	18
R125-96	72	TC	2.5			R131-96	0-6	OC	6.2		
R125-96	78	TC	2.6			R131-96	0	DS	3.2		
R125-96	84	TC	2.3			R131-96	6	TC	4.8		
R126-96	0	TC	2.8	16	16	R131-96	12	TC	4.2		
R126-96	0	DS	1.5			R131-96	18	TC	3.8		
R126-96	6	TC	3.9			R131-96	24	TC	4.0		
R126-96	12	TC	3.9			R131-96	30	TC	3.7		
R126-96	18	TC	3.9			R131-96	36	TC	3.6		
R126-96	24	TC	3.6			R132-96	0	TC	3.1	17	17
R126-96	30	TC	3.3			R132-96	0	DS	1.6		
R126-96	36	TC	3.5			R132-96	6	TC	3.3		
R127-96	0	TC	3.5	20	18	R132-96	12	TC	3.6		
R127-96	0-6	OC	6.5			R132-96	18	TC	3.9		
R127-96	0	DS	4.1			R132-96	24	TC	3.8		
R127-96	6	TC	5.3			R132-96	30	TC	3.8		
R127-96	12	TC	4.2			R132-96	36	TC	3.8		
R127-96	18	TC	3.7			R133-96	0	TC	17.3	51	36
R127-96	24	TC	3.6			R133-96	0	DS	37.0		
R127-96	30	TC	1.7			R133-96	6	TC	20.0		
R127-96	36	TC	2.2			R133-96	12	TC	6.8		
R128-96	0	TC	2.9	17	17	R133-96	18	TC	10.6		
R128-96	0	DS	1.1			R133-96	24	TC	13.2		
R128-96	6	TC	3.4			R133-96	30	TC	24.4		
R128-96	12	TC	4.0			R133-96	36	TC	22.6		
R128-96	18	TC	3.8			R133-96	42	TC	35.4		
R128-96	24	TC	3.7			R133-96	48	TC	60.5		
R128-96	30	TC	3.6			R133-96	54	TC	36.9		
R128-96	36	TC	3.6			R133-96	60	TC	36.3		
R129-96	0	TC	10.5	36	32	R133-96	66	TC	22.6		
R129-96	0	DS	11.5			R133-96	72	TC	23.8		
R129-96	6	TC	18.7			R133-96	78	TC	20.6		
R129-96	12	TC	11.1			R133-96	84	TC	14.0		
R129-96	18	TC	4.9			R134-96	0	TC	23.5	58	47
						R134-96	0	DS	38.5		

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil and Sediment Field Radiological Measurements
Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R129-96	24	TC	3.6			R134-96	6	TC	53.6		
R129-96	30	TC	2.9			R134-96	12	TC	10.1		
R129-96	36	TC	3.0			R134-96	18	TC	3.4		
						R134-96	24	TC	3.5		
R130-96	0	TC	13.1	51	42	R134-96	30	TC	3.2		
R130-96	0	DS	14.9			R134-96	36	TC	3.4		
R130-96	6	TC	22.7								
R130-96	12	TC	8.4			R135-96	0	TC	4.0	20	18
R135-96	0	DS	6.8			R141-96	0	TC	4.6	25	27
R135-96	6	TC	4.6			R141-96	0	DS	7.7		
R135-96	12	TC	4.9			R141-96	6	TC	5.7		
R135-96	18	TC	2.8			R141-96	12	TC	7.6		
R135-96	24	TC	2.9			R141-96	18	TC	10.7		
R135-96	30	TC	3.0			R141-96	24	TC	11.1		
R135-96	36	TC	2.9			R141-96	30	TC	7.0		
						R141-96	36	TC	4.9		
R136-96	0	TC	1.7	15	14						
R136-96	0	DS	<1.0			R142-96	0	TC	2.8	16	17
R136-96	6	TC	2.2			R142-96	0	DS	1.8		
R136-96	12	TC	3.0			R142-96	6	TC	3.3		
R136-96	18	TC	2.8			R142-96	12	TC	3.8		
R136-96	24	TC	2.7			R142-96	18	TC	4.0		
R136-96	30	TC	2.5			R142-96	24	TC	3.8		
						R142-96	30	TC	3.6		
R137-96	0	TC	35.9	111	73	R142-96	36	TC	3.5		
R137-96	0	DS	76.6								
R137-96	6	TC	24.7			R143-96	0	TC	1.6	15	15
R137-96	12	TC	7.1			R143-96	0	DS	<1.0		
R137-96	18	TC	3.0			R143-96	6	TC	2.2		
R137-96	24	TC	4.6			R143-96	12	TC	2.1		
R137-96	30	TC	4.3			R143-96	18	TC	2.2		
						R143-96	24	TC	2.4		
R138-96	0	TC	28.0	77	55	R143-96	30	TC	2.5		
R138-96	0	DS	61.7								
R138-96	6	TC	29.8			R144-96	0	TC	2.6	16	17
R138-96	12	TC	9.5			R144-96	0	DS	1.8		
R138-96	18	TC	7.0			R144-96	6	TC	4.2		
R138-96	24	TC	4.7			R144-96	12	TC	3.8		
R138-96	30	TC	4.1			R144-96	18	TC	2.6		
R138-96	36	TC	3.7			R144-96	24	TC	2.6		
						R144-96	30	TC	2.9		
R139-96	0	TC	2.8	17	16						
R139-96	0	DS	1.5			R145-96	0	TC	5.9	36	23
R139-96	6	TC	4.0			R145-96	0	DS	10.2		
R139-96	12	TC	3.7			R145-96	6	TC	24.8		
R139-96	18	TC	3.3			R145-96	12	TC	21.5		
R139-96	24	TC	3.4			R145-96	18	TC	3.5		
R139-96	30	TC	3.4			R145-96	24	TC	5.7		
						R145-96	30	TC	5.9		

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil Field Radiological Measurements; Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R140-96	0	TC	36.1	156	103	R146-96	0	TC	32.8	73	58
R140-96	0	DS	140.4			R146-96	0	DS	58.6		
R140-96	6	TC	101.2			R146-96	6	TC	69.5		
R140-96	12	TC	178.7			R146-96	12	TC	49.2		
R140-96	18	TC	58.3			R146-96	18	TC	16.7		
R140-96	24	TC	39.5			R146-96	24	TC	9.2		
R140-96	30	TC	12.0			R146-96	30	TC	6.3		
R140-96	36	TC	10.6								
R140-96	42	TC	8.8			R147-96	0	TC	23.5	47	44
R147-96	0	DS	28.1			R152-96	18	TC	6.0		
R147-96	6	TC	38.7			R152-96	24	TC	5.2		
R147-96	12	TC	82.9								
R147-96	18	TC	65.6			R153-96	0	TC	22.1	70	55
R147-96	24	TC	31.5			R153-96	0	DS	48.2		
R147-96	30	TC	16.8			R153-96	6	TC	36.1		
R147-96	36	TC	9.6			R153-96	12	TC	21.7		
						R153-96	18	TC	6.5		
R148-96	0	TC	14.4	40	38	R153-96	24	TC	6.8		
R148-96	0	DS	19.5								
R148-96	6	TC	26.8			R154-96	0	TC	17.7	44	21
R148-96	12	TC	48.4			R154-96	0	DS	30.0		
R148-96	18	TC	23.4			R154-96	6	TC	39.2		
R148-96	24	TC	12.6			R154-96	12	TC	9.7		
R148-96	30	TC	6.6			R154-96	18	TC	4.0		
R148-96	36	TC	4.0			R154-96	24	TC	3.5		
						R154-96	30	TC	3.3		
R149-96	0	TC	12.1	44	36						
R149-96	0	DS	23.9			R155-96	0	TC	21.5	70	47
R149-96	6	TC	19.5			R155-96	0	DS	59.6		
R149-96	12	TC	9.3			R155-96	6	TC	31.0		
R149-96	18	TC	7.0			R155-96	12	TC	26.7		
R149-96	24	TC	6.0			R155-96	18	TC	10.8		
R149-96	30	TC	4.5			R155-96	24	TC	5.5		
R149-96	36	TC	4.2			R155-96	30	TC	5.0		
R150-96	0	TC	31.7	73	58	R156-96	0	TC	17.2	55	51
R150-96	0	DS	42.0			R156-96	0	DS	30.9		
R150-96	6	TC	56.2			R156-96	6	TC	43.2		
R150-96	12	TC	63.8			R156-96	12	TC	36.3		
R150-96	18	TC	119.2			R156-96	18	TC	14.3		
R150-96	24	TC	117.1			R156-96	24	TC	7.1		
R150-96	30	TC	30.9			R156-96	30	TC	6.0		
R150-96	36	TC	7.7								
R150-96	42	TC	5.9			R157-96	0	TC	3.2	19	18
						R157-96	0	DS	<1.0		
R151-96	0	TC	6.0	25	23	R157-96	6	TC	3.9		
R151-96	0	DS	9.4			R157-96	12	TC	4.0		
R151-96	6	TC	10.4			R157-96	18	TC	3.5		
R151-96	12	TC	10.2			R157-96	24	TC	3.5		

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil and Sediment Field Radiological Measurements
Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R151-96	18	TC	19.3								
R151-96	24	TC	14.5			R158-96	0	TC	5.1	23	21
R151-96	30	TC	3.5			R158-96	0	DS	9.3		
R151-96	36	TC	3.3			R158-96	6	TC	7.9		
R151-96	42	TC	3.8			R158-96	12	TC	6.6		
R151-96	48	TC	3.2			R158-96	18	TC	5.8		
						R158-96	24	TC	5.5		
R152-96	0	TC	23.5	81	66	R159-96	0	TC	4.3	44	36
R152-96	0	DS	59.3			R159-96	0	DS	38.1		
R152-96	6	TC	39.4			R159-96	6	TC	13.4		
R152-96	12	TC	10.0			R165-96	0	TC	8.8	36	29
R159-96	12	TC	4.3			R165-96	0	DS	16.1		
R159-96	18	TC	3.9			R165-96	6	TC	14.4		
R159-96	24	TC	3.5			R165-96	12	TC	8.0		
						R165-96	18	TC	6.6		
R160-96	0	TC	2.6	17	17	R165-96	24	TC	5.9		
R160-96	0	DS	1.3			R165-96	30	TC	3.8		
R160-96	6	TC	3.3			R165-96	36	TC	4.3		
R160-96	12	TC	3.6								
R160-96	18	TC	5.4			R166-96	0	TC	2.9	17	16
R160-96	24	TC	7.7			R166-96	0	DS	1.9		
R160-96	30	TC	9.6			R166-96	6	TC	4.0		
R160-96	36	TC	9.4			R166-96	12	TC	3.9		
R160-96	42	TC	10.2			R166-96	18	TC	3.7		
R160-96	48	TC	11.2			R166-96	24	TC	3.7		
R160-96	54	TC	6.6			R166-96	30	TC	3.6		
R160-96	60	TC	6.4								
						R167-96	0	TC	5.3	25	19
R161-96	0	TC	8.7	30	27	R167-96	0	DS	9.2		
R161-96	0	DS	11.5			R167-96	6	TC	4.5		
R161-96	6	TC	19.5			R167-96	12	TC	3.5		
R161-96	12	TC	68.4			R167-96	18	TC	3.7		
R161-96	18	TC	21.2			R167-96	24	TC	3.6		
R161-96	24	TC	6.6			R167-96	30	TC	3.6		
R161-96	30	TC	10.4								
R161-96	36	TC	5.6			R168-96	0	TC	3.9	20	18
						R168-96	0-6	OC	6.9		
R162-96	0	TC	1.7	16	15	R168-96	0	DS	4.5		
R162-96	0	DS	<1.0			R168-96	6	TC	6.2		
R162-96	6	TC	2.3			R168-96	12	TC	4.6		
R162-96	12	TC	3.0			R168-96	18	TC	3.7		
R162-96	18	TC	3.2			R168-96	24	TC	4.0		
R162-96	24	TC	3.0			R168-96	30	TC	4.2		
R162-96	30	TC	2.9			R168-96	36	TC	4.0		
R163-96	0	TC	3.0	16	16	R169-96	0	TC	8.4	25	21
R163-96	0-6	OC	3.5			R169-96	0	DS	8.0		
R163-96	0	DS	2.4			R169-96	6	TC	9.3		
R163-96	6	TC	4.0								

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil Field Radiological Measurements; Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R163-96	12	TC	4.2			R169-96	12	TC	41.3		
R163-96	18	TC	4.8			R169-96	18	TC	175.3		
R163-96	24	TC	4.1			R169-96	24	TC	181.7		
R163-96	30	TC	4.4			R169-96	30	TC	63.0		
R163-96	36	TC	3.7			R169-96	36	TC	4.7		
R164-96	0	TC	2.6	15	15	R169-96	42	TC	12.4		
R164-96	0	DS	1.1			R169-96	48	TC	8.6		
R164-96	6	TC	3.2			R169-96	54	TC	3.2		
R164-96	12	TC	3.4			R169-96	60	TC	3.0		
R164-96	18	TC	3.8			R170-96	0	TC	13.9	29	23
R164-96	24	TC	3.2			R170-96	0	DS	14.9		
R164-96	30	TC	3.6			R170-96	6	TC	24.2		
R170-96	12	TC	40.1			R175-96	30	TC	4.0		
R170-96	18	TC	67.5			R176-96	0	TC	5.5	30	29
R170-96	24	TC	146.3			R176-96	0	DS	11.5		
R170-96	30	TC	134.7			R176-96	6	TC	8.3		
R170-96	36	TC	64.0			R176-96	12	TC	10.4		
R170-96	42	TC	24.0			R176-96	18	TC	6.3		
R170-96	48	TC	5.6			R176-96	24	TC	4.4		
R170-96	54	TC	6.7			R176-96	30	TC	3.3		
R171-96	0	TC	4.9	25	18	R176-96	36	TC	3.3		
R171-96	0	DS	12.0			W48	0-6	SS	1.0		
R171-96	6	TC	7.1			W48	0	DS	2.6		
R171-96	12	TC	4.3			W48	6	DS	3.8		
R171-96	18	TC	3.6			W51	0-6	SS	3.0		
R171-96	24	TC	4.0			W51	0	DS	<1.0		
R171-96	30	TC	3.7			W51	12-18	SS	6.0		
R171-96	36	TC	3.6			W60	0-6	SS	40.0		
R172-96	0	TC	7.8	32	25	W60	0	DS	28.0		
R172-96	0	DS	14.0			W60	6-12	SS	67.0		
R172-96	6	TC	11.7			W60	6	DS	33.3		
R172-96	12	TC	5.8			W60	12	DS	9.4		
R172-96	18	TC	4.8			W60	18	DS	8.5		
R172-96	24	TC	5.3			W61	0-6	SS	6.0		
R172-96	30	TC	4.7			W61	0	DS	4.6		
R172-96	36	TC	4.6			W61	6	DS	5.2		
R173-96	0	TC	5.3	21	18	W65	0-6	SS	2.0		
R173-96	0	DS	7.1			W65	0	DS	1.7		
R173-96	6	TC	6.9			W66	0	DS	13.2		
R173-96	12	TC	5.0			W66	6	DS	8.2		
R173-96	18	TC	4.1			W67	0	DS	12.2		
R173-96	24	TC	4.0								
R173-96	30	TC	3.7								
R173-96	36	TC	3.3								
R174-96	0	TC	2.6	16	15						

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1a (continued). 1996 Soil and Sediment Field Radiological Measurements
Operable Unit III

Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr	Sample Loc.	Depth inches	Ra226 Meas. Type ^a	Ra226 pCi/g	Ground Gamma μ R/hr	Waist Gamma μ R/hr
Down-Gradient - Upper Montezuma Creek						Down-Gradient - Upper Montezuma Creek					
R174-96	0	DS	1.0			W67	6	DS	1.6		
R174-96	6	TC	4.0								
R174-96	12	TC	4.2			W73	0	TC	4.8		
R174-96	18	TC	5.0			W73	0	DS	8.2		
R174-96	24	TC	3.8			W73	6	TC	5.6		
R174-96	30	TC	3.9			W73	12	TC	7.6		
R174-96	36	TC	3.4			W73	18	TC	19.8		
						W73	24	TC	25.7		
R175-96	0	TC	7.1	30	21	W73	30	TC	24.4		
R175-96	0	DS	14.1			W73	36	TC	13.7		
R175-96	6	TC	20.5			W73	42	TC	6.7		
R175-96	12	TC	13.9			W73	48	TC	4.9		
R175-96	18	TC	4.4			W73	54	TC	5.3		
R175-96	24	TC	3.8								
W77	0-6	SS	3.0			W98	6	DS	5.5		
W77	0	DS	4.8								
W77	6-12	SS	2.0			W99	0-6	SS	3.0		
W77	6	DS	6.0			W99	0	DS	3.0		
W77	12	DS	4.5			W99	6	DS	2.9		
W82	0-6	SS	2.0			W105	0	TC	3.8		
W82	0	DS	2.8			W105	0	DS	5.0		
W82	6	DS	2.7			W105	6	TC	5.5		
						W105	12	TC	4.2		
W83	0	TC	7.1								
W83	0-6	SS	13.0			W112	0-6	SS	4.0		
W83	0	DS	11.2			W112	0	DS	4.7		
W83	6	TC	9.2			W112	6	DS	5.0		
W83	6-12	SS	19.0								
W83	6	DS	17.9			W95	0	DS	9.7		
W83	12	TC	4.8			W95	6	DS	4.6		
W83	12	DS	11.8								
W83	18	TC	2.9			W96	0-6	SS	25.0		
W83	22	TC	3.0			W96	0	DS	22.6		
						W96	6-12	SS	103.0		
W84	0-6	SS	2.0			W96	6	DS	62.5		
W84	0	DS	10.9			W96	12	DS	7.1		
W84	6	DS	4.4			W98	0-6	SS	10.0		
						W98	0	DS	9.3		
W89	0	DS	14.9								
W89	6	DS	3.8			W94	0-6	SS	12.0		
						W94	0	DS	7.4		
W92	0-6	SS	131.0			W94	6	DS	7.6		
W92	0	DS	63.6								
W92	6-12	SS	42.0								
W92	6	DS	22.5								
W92	12-18	SS	6.0								
W92	12	DS	8.4								
W92	18	DS	6.7								

^aRadium-226 field measurement types: DS = Delta Scintillometer, OC = Soil Sample by Opp. Crys. Sys., TC = Total Count Borehole, SS = Soil Sample by Laboratory Analysis.

Table 5-1b. Soil and Sediment Radiological Data: Operable Unit III^a

Sample Location	Sample Date	Sample Type	Pb210 (pCi/g)	Ra226 (pCi/g)	Th230 (pCi/g)	U (mg/kg)	U234 (pCi/g)	U235 (pCi/g)	U238 (pCi/g)
Down-Gradient - Upper Canyon									
01SD95-01 0-3"	08/25/1995	Sediment	2.4	5.5	4.5	No Data	2.6	0.20U	3.1
01SS95-01 0-3"	07/17/1995	Soil	8.5	14.5	14.7	No Data	4.4	0.20U	4.6
01SS95-01 3-24"	07/17/1995	Soil	8.1	16.6	17.6	No Data	5.5	0.20U	5.7
01SS95-02 0-3"	07/18/1995	Soil	2U	4.8	4.6	No Data	2.1	0.20U	2.3
01SS95-02 3-24"	07/18/1995	Soil	2U	5.4	4.9	No Data	2.5	0.20U	2.7
02SD95-01 0-3"	08/25/1995	Sediment	5.3	9.2	8.7	No Data	4.7	0.20J	5.5
02SS95-01 0-3"	07/17/1995	Soil	7.8	16.2	16.6	No Data	5.8	0.20U	6.2
02SS95-01 3-24"	07/17/1995	Soil	2U	2.6	2.5	No Data	2.7	0.20U	3.0
02SS95-02 0-3"	07/17/1995	Soil	2U	2.6	2.4	No Data	1.4	0.20U	1.6J
02SS95-02 3-24"	07/17/1995	Soil	2U	2.4	2.3	No Data	1.4	0.20U	1.6J
03SD95-01 0-3"	08/25/1995	Sediment	3.9	7.3	6.3	No Data	5.6	0.21J	6.1
03SS95-01 0-3"	07/18/1995	Soil	69.9	115	125	No Data	31.1	1.4J	33.3
03SS95-01 3-24"	07/18/1995	Soil	41.9	75.3	77.7	No Data	20.0	0.86J	20.6
03SS95-01 3-24" (Dup)	07/18/1995	Soil	42.6	73.0	81.2	No Data	19.1	0.86J	20.8
03SS95-02 0-3"	07/18/1995	Soil	4.3	7.7	7.4	No Data	3.4	0.20U	3.5
03SS95-02 3-24"	07/18/1995	Soil	2U	3.2	2.6	No Data	1.8	0.20U	1.8J
04SD95-01 0-3"	08/28/1995	Sediment	8.2	11.9	15.8	No Data	6.2	0.22J	6.3
04SS95-01 0-3"	07/19/1995	Soil	17.5	30.8	35.1	No Data	7.3	0.23J	7.9
04SS95-01 3-24"	07/19/1995	Soil	12.3	24.5	29.4	No Data	7.2	0.22J	7.5
04SS95-02 0-3"	07/19/1995	Soil	4.6	8.4	9.1	No Data	2.7	0.20U	3.0
04SS95-02 3-24"	07/19/1995	Soil	2U	2.7	3.5	No Data	1.8	0.20U	2.0
05SS95-01 0-3"	07/19/1995	Soil	15.7	27.9	26.9	No Data	9.2	0.30J	9.5
05SS95-01 3-24"	07/19/1995	Soil	73.5	99.7	118	No Data	19.0	0.74J	18.6
05SS95-01 3-24" (Dup)	07/19/1995	Soil	78.4	107	115	No Data	18.9	0.76J	18.9
05SS95-02 0-3"	07/19/1995	Soil	2U	2.3	2.6	No Data	1.6	0.20U	1.8J
05SS95-02 3-24"	07/19/1995	Soil	2U	1.2	1.1	No Data	0.99	0.20U	1.1J
21SD96-01 0-3"	05/22/1996	Sediment	5.7	4.5	6.7	16.6	5.6	0.36	5.6
21SD96-01 0-3" (Dup)	05/22/1996	Sediment	5.0	3.9	6.0	16.4	5.3	0.07U	5.8
21SD96-02 0-3"	05/22/1996	Sediment	7.2	8.0	9.7	23.5	8.2	0.38	7.9
21SS96-N 0-3"	05/22/1996	Soil	2.6	1.3	1.8U	3.7	0.99	0.07U	1.2
21SS96-N 3-24"	05/22/1996	Soil	3.7	3.0	3.3U	5.4	1.7	0.09U	2.0
21SS96-S 0-3"	05/22/1996	Soil	4.5	3.3	4.0	7.0	2.3	0.15U	2.7
21SS96-S 3-24"	05/22/1996	Soil	8.7	7.7	7.4	9.6	3.4	0.09U	3.4
22SD96-01 0-3"	05/22/1996	Sediment	10.7	11.2	13.6	19.1	6.9	0.08U	6.9

^aDefinition of Qualifiers: R -- Data unusable. J -- Estimated quantity. U -- Not detected; value is sample detection limit. UJ -- Not detected, associated value is estimated.

Table 5-1b (continued). Soil and Sediment Radiological Data; Operable Unit III^a

Sample Location	Sample Date	Sample Type	Pb210 (pCi/g)	Ra226 (pCi/g)	Th230 (pCi/g)	U (mg/kg)	U234 (pCi/g)	U235 (pCi/g)	U238 (pCi/g)
Down-Gradient - Upper Canyon									
22SD96-02 0-3"	05/22/1996	Sediment	7.6	5.9	7.8	54.3	19.3	0.97	19.0
22SD96-03 0-3"	05/22/1996	Sediment	8.7	5.8	8.5	40.1	14.0	0.60	13.8
22SD96-04 0-3"	05/22/1996	Sediment	6.0	6.2	6.3	20.3	7.4	0.06U	7.4
22SD96-05 0-3"	05/22/1996	Sediment	5.6	4.4	5.8	17.8	5.9	0.68	6.0
22SD96-06 0-3"	05/24/1996	Sediment	12.3J	10.9	14.9	35.2	11.5	0.54	12.1
22SD96-07 9-15"	06/06/1996	Sediment	17.8	19.9	21.0	52.8	14.3	0.66	14.4
22SD96-07 9-15" (Dup)	06/06/1996	Sediment	16.6	18.1	23.2	40.8	15.0	0.77	14.8
22SS96-N 0-3"	05/22/1996	Soil	13.1	12.2	15.8	16.2	5.5	0.49	6.0
22SS96-N 3-24"	05/22/1996	Soil	33.8	36.8	45.2	26.7	9.2	0.40	9.3
22SS96-N2 0-3"	05/22/1996	Soil	30.9	31.0	42.7	27.0	9.9	0.47	9.6
22SS96-N2 3-24"	05/22/1996	Soil	53.9	62.3	75.5	37.6	13.7	0.72	13.7
23SD96-01 0-3"	05/24/1996	Sediment	50.6	38.7	32.4	27.9	10.2	0.45	10.0
23SD96-02 0-3"	05/24/1996	Sediment	10.6	9.0	12.2	28.4	9.7	0.56	9.9
23SD96-03 0-3"	05/24/1996	Sediment	7.6	7.6	10.1	18.0	5.9	0.41	6.0
23SD96-04 0-3"	05/24/1996	Sediment	3.9	4.2	5.7	9.6	3.3	0.07U	3.5
23SD96-05 0-3"	05/24/1996	Sediment	4.5	5.0	5.0	13.3	4.4	0.26	4.5
23SD96-06 0-3"	05/24/1996	Sediment	13.9	19.7	26.5	25.6	9.2	0.41	9.6
23SD96-07 18-24"	06/06/1996	Sediment	8.7	8.0	8.7	27.2	9.3	0.48	9.5
23SD96-07 18-24" (Dup)	06/06/1996	Sediment	9.2	8.6	9.0	26.4	9.2	0.42	9.2
23SS96-N 0-3"	05/24/1996	Soil	14.4	16.5	22.6	17.9	6.3	0.26	6.6
23SS96-N 3-24"	05/24/1996	Soil	15.7	22.7	22.8	14.9	6.5	0.13U	6.7
23SS96-S 0-3"	05/24/1996	Soil	6.2	7.3	8.7	11.1	3.9	0.06U	3.7
23SS96-S 3-24"	05/24/1996	Soil	2.2	2.8	3.7	11.1	3.7	0.11U	4.0
BPSD95-01 0-7"	08/22/1995	Sediment	8.7	12.4	12.1	No Data	8.5	0.38J	9.3
BPSD95-02 0-6"	08/22/1995	Sediment	10.8	12.3	12.1	No Data	6.6	0.25J	7.0
BPSD95-02 0-18"	08/22/1995	Sediment	4.3	8.5	7.5	No Data	4.8	0.20U	5.2
BPSD95-03 0-6"	08/23/1995	Sediment	5.2	5.9	5.5	No Data	3.6	0.20U	3.9
BPSD95-03 0-12"	08/23/1995	Sediment	8.2	9.6	9.5	No Data	4.8	0.20U	5.2
BPSD95-04 0-6"	08/23/1995	Sediment	9.0	8.3	7.4	No Data	5.7	0.20U	5.9
BPSD95-05 0-6"	08/23/1995	Sediment	6.5	8.2	7.6	No Data	3.0	0.20U	2.9
HH1-96 0-3"	05/22/1996	Soil	26.8	31.0	38.8	35.2	12.4	0.58	12.8
HH2-96 0-3"	05/22/1996	Soil	17.0	19.9	22.1	20.8	6.9	0.35	7.5
HH3-96 0-3"	05/22/1996	Soil	18.1	23.4	28.0	22.1	7.9	0.36	7.5
HH4-96 0-3"	05/22/1996	Soil	22.8	25.7	33.3	20.9	7.2	0.29	7.3

^aDefinition of Qualifiers: R -- Data unusable. J -- Estimated quantity. U -- Not detected; value is sample detection limit. UJ -- Not detected, associated value is estimated.

Table 5-1b (continued). Soil and Sediment Radiological Data: Operable Unit III^a

Sample Location	Sample Date	Sample Type	Pb210 (pCi/g)	Ra226 (pCi/g)	Th230 (pCi/g)	U (mg/kg)	U234 (pCi/g)	U235 (pCi/g)	U238 (pCi/g)
Down-Gradient - Upper Canyon									
HH5-96 0-3"	05/22/1996	Soil	7.9	8.5	11.2	11.8	3.7	0.61	3.5
HH6-96 0-3"	05/23/1996	Soil	11.2	14.6	20.9	16.9	6.4	0.30	6.2
HH7-96 0-3"	05/23/1996	Soil	3.8	5.3	6.3	9.9	3.4	0.04U	3.4
HH8-96 0-3"	05/23/1996	Soil	19.4	23.8	29.9	21.8	8.4	0.42	8.5
HH9-96 0-3"	05/23/1996	Soil	9.8	9.7	12.8	11.9	4.4	0.09U	4.4
HH10-96 0-3"	05/23/1996	Soil	5.4	5.4	7.7	11.4	4.2	0.09U	4.3
HH11-96 0-3"	05/23/1996	Soil	5.8	5.0	7.1	15.6	5.4	0.12U	5.1
HH12-96 0-3"	05/23/1996	Soil	6.2	6.9	8.4	18.8	7.1	0.23	7.0
HH13-96 0-3"	05/23/1996	Soil	30.4	32.2	44.3	33.6	11.7	0.58	12.1
HH15-96 0-3"	05/29/1996	Soil	7.5	8.0	10.8	19.6	8.4	0.40	9.1
HH16-96 0-3"	05/29/1996	Soil	7.4	7.2	10.9	24.5	6.3	0.24	6.6
IPSD95-01 0-6"	08/22/1995	Sediment	2U	4.9	4.2	No Data	5.1	0.20U	5.2
IPSD95-01 0-24"	08/22/1995	Sediment	2.4	5.3	4.1	No Data	9.0	0.37J	9.4
IPSD95-02 0-6"	08/22/1995	Sediment	4.9	8.4	7.0	No Data	4.1	0.20U	4.2
IPSD95-02 0-20"	08/22/1995	Sediment	4.8	7.5	7.2	No Data	3.4	0.20U	3.7
IPSD95-03 0-6"	08/22/1995	Sediment	2U	6.2	5.8	No Data	3.2	0.20U	3.9
IPSD95-03 0-24"	08/22/1995	Sediment	2.8	4.5	4.6	No Data	5.7	0.22J	6.2
IPSD95-04 0-6"	08/22/1995	Sediment	2.6	6.9	5.3	No Data	3.8	0.20U	4.1
IPSD95-04 0-18"	08/22/1995	Sediment	2U	5.4	4.2	No Data	7.5	0.32J	8.2
IPSD95-05 0-6"	08/22/1995	Sediment	3.3	5.8	5.0	No Data	3.4	0.20U	3.4
IPSD95-05 0-24"	08/22/1995	Sediment	5.6	4.8	4.9	No Data	4.7	0.20U	5.3
IPSD95-05 0-24" (Dup)	08/22/1995	Sediment	5.0	4.9	4.6	No Data	4.7	0.20U	5.2
R1-96 0-3"	05/23/1996	Soil	5.6	6.4	8.6	10.5	3.9	0.17	3.7
R1-96 15-21"	05/23/1996	Soil	63.5	75.2	93.6	33.7	12.4	0.50	12.3
R2-96 0-3"	05/23/1996	Soil	1.4U	1.3	1.8	3.8	1.3	0.04U	1.2
R2-96 3-9"	05/29/1996	Soil	1.3U	0.96	2.2	16.8	1.0	0.06U	1.0
R3-96 0-3"	05/22/1996	Soil	1.5U	2.0	1.9	4.4	1.3	0.05U	1.4
R3-96 3-9"	05/22/1996	Soil	1.3U	1.4	1.3	3.4	1.1	0.08U	1.1
R3-96 3-9" (Dup)	05/22/1996	Soil	1.4U	1.3	1.3	3.4	1.1	0.05U	1.2
R4-96 0-3"	05/22/1996	Soil	20.3	30.9	36.9	20.4	6.9	0.33	7.0
R5-96 0-3"	05/22/1996	Soil	26.0	34.2	47.2	27.9	10.3	0.41	10.2
R5-96 9-15"	05/22/1996	Soil	18.2	27.4	28.1	20.8	7.6	0.34	7.4
R6-96 0-3"	05/22/1996	Soil	14.0	19.8	21.4	20.3	6.4	0.31	6.5
R6-96 3-9"	05/29/1996	Soil	7.4	8.7	12.2	10.5	3.3	0.12	3.2

^aDefinition of Qualifiers: R -- Data unusable. J -- Estimated quantity. U -- Not detected; value is sample detection limit. UJ -- Not detected; associated value is estimated.

Table 5-1b (continued). Soil and Sediment Radiological Data: Operable Unit III^a

Sample Location	Sample Date	Sample Type	Pb210 (pCi/g)	Ra226 (pCi/g)	Th230 (pCi/g)	U (mg/kg)	U234 (pCi/g)	U235 (pCi/g)	U238 (pCi/g)
Down-Gradient - Upper Canyon									
R7-96 0-3"	05/22/1996	Soil	27.4	29.6	30.8	23.9	7.9	0.41	8.2
R7-96 3-9"	05/22/1996	Soil	121	131	166	70.5	24.8	1.0	23.7
R8-96 0-3"	05/22/1996	Soil	22.8	23.6	30.6	23.5	7.9	0.32	7.7
R8-96 3-9"	05/22/1996	Soil	20.0	20.7	28.0	23.4	8.0	0.35	8.1
R9-96 0-3"	05/22/1996	Soil	3.8	2.5	2.8U	4.9	1.6	0.06U	1.5
R10-96 0-3"	05/23/1996	Soil	16.2	19.5	23.1	14.5	4.8	0.25	5.3
R11-96 0-3"	05/23/1996	Soil	94.2	111	133	93.3	32.4	2.1	32.7
R11-96 3-9"	05/23/1996	Soil	49.4	55.7	67.4	44.2	16.3	2.1	15.8
R12-96 0-3"	05/23/1996	Soil	6.6	8.1	11.7	10.8	3.8	0.05U	4.2
R12-96 0-3" (Dup)	05/23/1996	Soil	7.6	7.7	10.4	10.8	3.9	0.06U	4.0
R13-96 0-3"	05/29/1996	Soil	7.8	11.4	14.9	2.9	5.7	0.32	5.5
R15-96 0-3"	05/29/1996	Soil	3.8	4.0	5.2	7.4	2.6	0.09	2.7
R16-96 0-3"	05/29/1996	Soil	34.5	56.2	65.1	46.3	15.6	0.61	15.4
R16-96 3-9"	05/29/1996	Soil	20.8	26.8	37.3	20.1	7.2	0.28	7.7
R17-96 0-3"	05/29/1996	Soil	17.9	30.4	35.0	24.7	8.7	0.33	9.1
R39-96 0-3"	05/29/1996	Soil	4.0	3.6	4.8	20.8	7.7	0.56	7.9
R39-96 3-9"	05/29/1996	Soil	7.2	8.7	8.8	18.8	6.1	0.35	6.1
S94-015 0-6"	11/16/1994	Sediment	2U	3.7	4.4	12.2	No Data	No Data	No Data
S94-016 0-6"	11/11/1994	Sediment	6.1	6.6	12.7	17.2	No Data	No Data	No Data
S94-016 0-6" (Dup)	11/11/1994	Sediment	6.3	4.1	12.2	17.1	No Data	No Data	No Data
S94-016 6-12"	11/11/1994	Sediment	16.4	7.9	29.1	18.9	No Data	No Data	No Data
S94-016 12-18"	11/11/1994	Sediment	13.9	6.6	20.0	17.1	No Data	No Data	No Data
SS94-001 0-6"	11/16/1994	Soil	16.3	35.5	36.2	31.2	No Data	No Data	No Data
SS94-001 6-12"	11/16/1994	Soil	5.7	14.1	15.2	13.6	No Data	No Data	No Data
SS94-002 0-6"	11/16/1994	Soil	2U	3.9	4.0	6.9	No Data	No Data	No Data
SS94-002 0-6" (Dup)	11/16/1994	Soil	2U	3.7	3.8	7.3	No Data	No Data	No Data
SS94-003 0-6"	11/16/1994	Soil	8.4	16.6	16.3	16.4	No Data	No Data	No Data
SS94-003 6-12"	11/16/1994	Soil	16.1	32.9	38.7	23.6	No Data	No Data	No Data
SS94-003 12-18"	11/16/1994	Soil	9.8	22.8	23.7	19.2	No Data	No Data	No Data
SS94-003 18-24"	11/16/1994	Soil	3.7	10	11.3	12.5	No Data	No Data	No Data
SS94-003 18-24" (Dup)	11/16/1994	Soil	4.7	10.9	11.6	12.8	No Data	No Data	No Data
SS94-004 0-6"	11/15/1994	Soil	16.4	32.7	34.4	44.1	No Data	No Data	No Data
SS94-004 6-12"	11/15/1994	Soil	4.0	8.2	7.7	17.9	No Data	No Data	No Data
SS94-004 12-18"	11/15/1994	Soil	18.3	27.0	27.1	20.3	No Data	No Data	No Data

^aDefinition of Qualifiers: R -- Data unusable. J -- Estimated quantity. U -- Not detected; value is sample detection limit. W -- Not detected. associated value is estimated.

Table 5-1b (continued). Soil and Sediment Radiological Data: Operable Unit III^a

Sample Location	Sample Date	Sample Type	Pb210 (pCi/g)	Ra226 (pCi/g)	Th230 (pCi/g)	U (mg/kg)	U234 (pCi/g)	U235 (pCi/g)	U238 (pCi/g)
Down-Gradient - Upper Canyon									
SS94-004 18-24"	11/15/1994	Soil	43.8	56.7	61.6	23.4	No Data	No Data	No Data
SS94-005 0-6"	11/15/1994	Soil	20.9	48.5	44.1	33.5	No Data	No Data	No Data
SS94-005 6-12"	11/15/1994	Soil	3.0	7.2	8.5	8.9	No Data	No Data	No Data
SS94-006 0-6"	11/15/1994	Soil	2U	5.7	5.6	6.4	No Data	No Data	No Data
SS94-006 6-12"	11/15/1994	Soil	2.8	7.6	7.4	8.1	No Data	No Data	No Data
SS94-006 12-18"	11/15/1994	Soil	10.1	3.1	3.6	6.0	No Data	No Data	No Data
SS94-006 18-24"	11/15/1994	Soil	2U	2.4	3.0	5.0	No Data	No Data	No Data
SS94-006 18-24" (Dup)	11/15/1994	Soil	2U	2.6	2.9	4.8	No Data	No Data	No Data
SS94-007 0-6"	11/15/1994	Soil	2U	3.9	3.5	5.1	No Data	No Data	No Data
SS94-008 0-6"	11/15/1994	Soil	2U	3.9	4.5	5.4	No Data	No Data	No Data
SS94-009 0-6"	11/14/1994	Soil	71.5	74.2	160	98.9	No Data	No Data	No Data
SS94-009 6-12"	11/14/1994	Soil	88.4	137	203	118	No Data	No Data	No Data
SS94-009 12-18"	11/14/1994	Soil	30.0	50.9	73.8	54.9	No Data	No Data	No Data
SS94-009 18-24"	11/14/1994	Soil	10.7	23.9	25.6	29.3	No Data	No Data	No Data
SS94-010 0-6"	11/14/1994	Soil	12.3	23.1	28.3	21.8	No Data	No Data	No Data
SS94-010 6-12"	11/14/1994	Soil	21.8	12.8	44.9	28.2	No Data	No Data	No Data
SS94-010 12-18"	11/14/1994	Soil	5.2	9.3	12.4	14.2	No Data	No Data	No Data
SS94-010 18-24"	11/14/1994	Soil	12.9	14.8	26.8	18.9	No Data	No Data	No Data
SS94-011 0-6"	11/15/1994	Soil	4.0	12.0	11.1	16.1	No Data	No Data	No Data
SS94-011 0-6" (Dup)	11/15/1994	Soil	6.8	11.0	10.9	15.5	No Data	No Data	No Data
SS94-011 6-12"	11/15/1994	Soil	21.4	30.1	45.2	30.5	No Data	No Data	No Data
SS94-011 12-18"	11/15/1994	Soil	6.7	7.2	13.7	18.0	No Data	No Data	No Data
SS94-011 18-24"	11/15/1994	Soil	4.8	5.1	8.1	15.9	No Data	No Data	No Data
UBPSD95-01 0-6"	08/23/1995	Sediment	6.6	8.2	7.8	No Data	3.4	0.20U	3.6
UBPSD95-01 0-24"	08/23/1995	Sediment	2U	2.7	0.15U	No Data	2.1	0.20U	2.2
UBPSD95-02 0-6"	08/23/1995	Sediment	40.7	55.1	56.4	No Data	9.7	0.43J	10.3
UBPSD95-02 0-12"	08/23/1995	Sediment	18.6	25.9	26.5	No Data	6.8	0.26J	7.3
UBPSD95-03 0-6"	08/23/1995	Sediment	2.4	4.4	3.8	No Data	2.8	0.20U	2.8
UBPSD95-03 0-24"	08/23/1995	Sediment	2U	3.3	2.8	No Data	2.5	0.20U	2.6
UBPSD95-04 0-6"	08/23/1995	Sediment	6.0	7.8	9.5	No Data	15.7	0.75J	17.0
UBPSD95-05 0-6"	08/23/1995	Sediment	25.7	37.5	39.7	No Data	10.2	0.45J	10.7

^aDefinition of Qualifiers: R -- Data unusable. J -- Estimated quantity. U -- Not detected; value is sample detection limit. UJ -- Not detected, associated value is estimated.

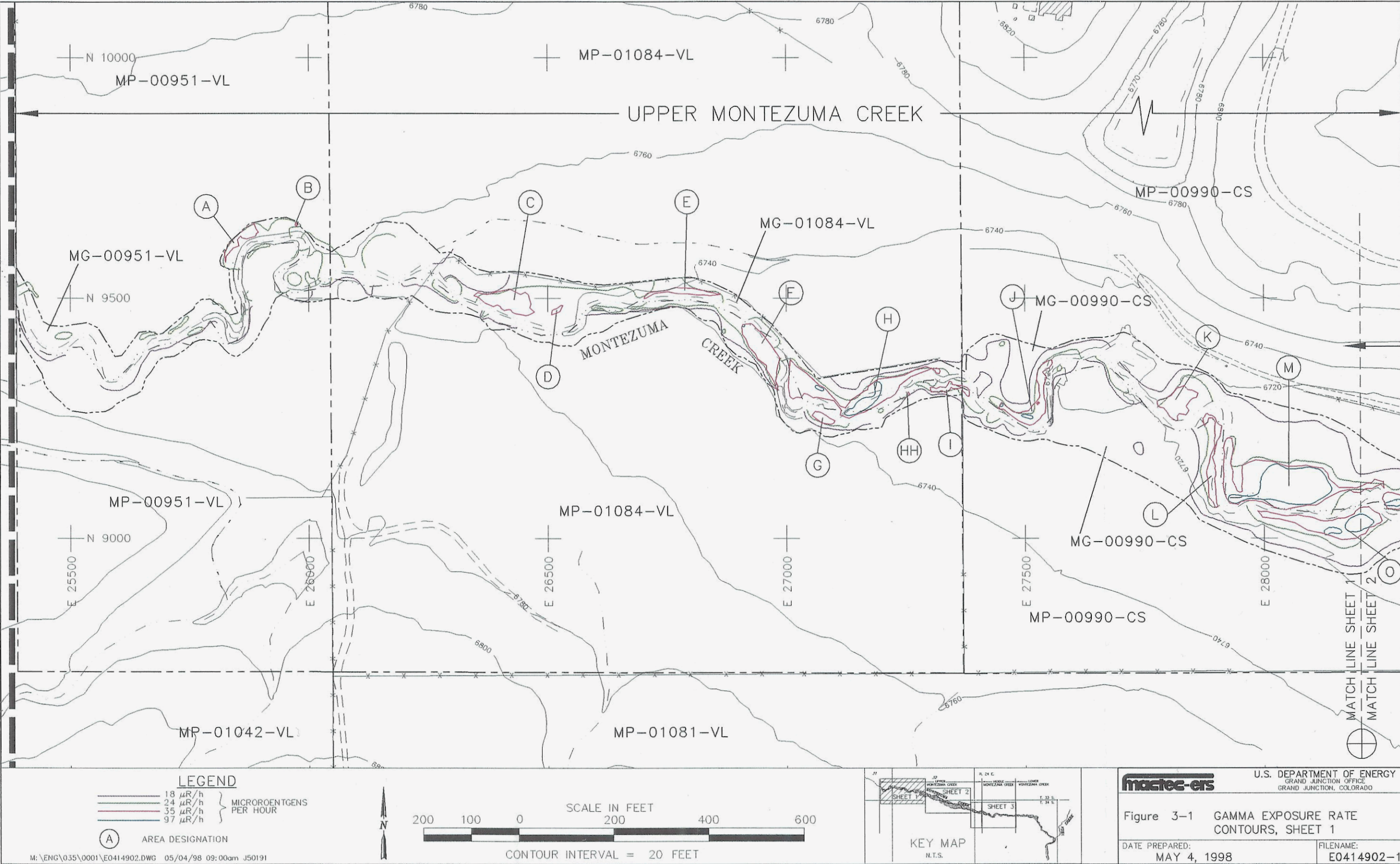


Figure 3-1. Gamma Exposure Rate Contours (Sheet 1)

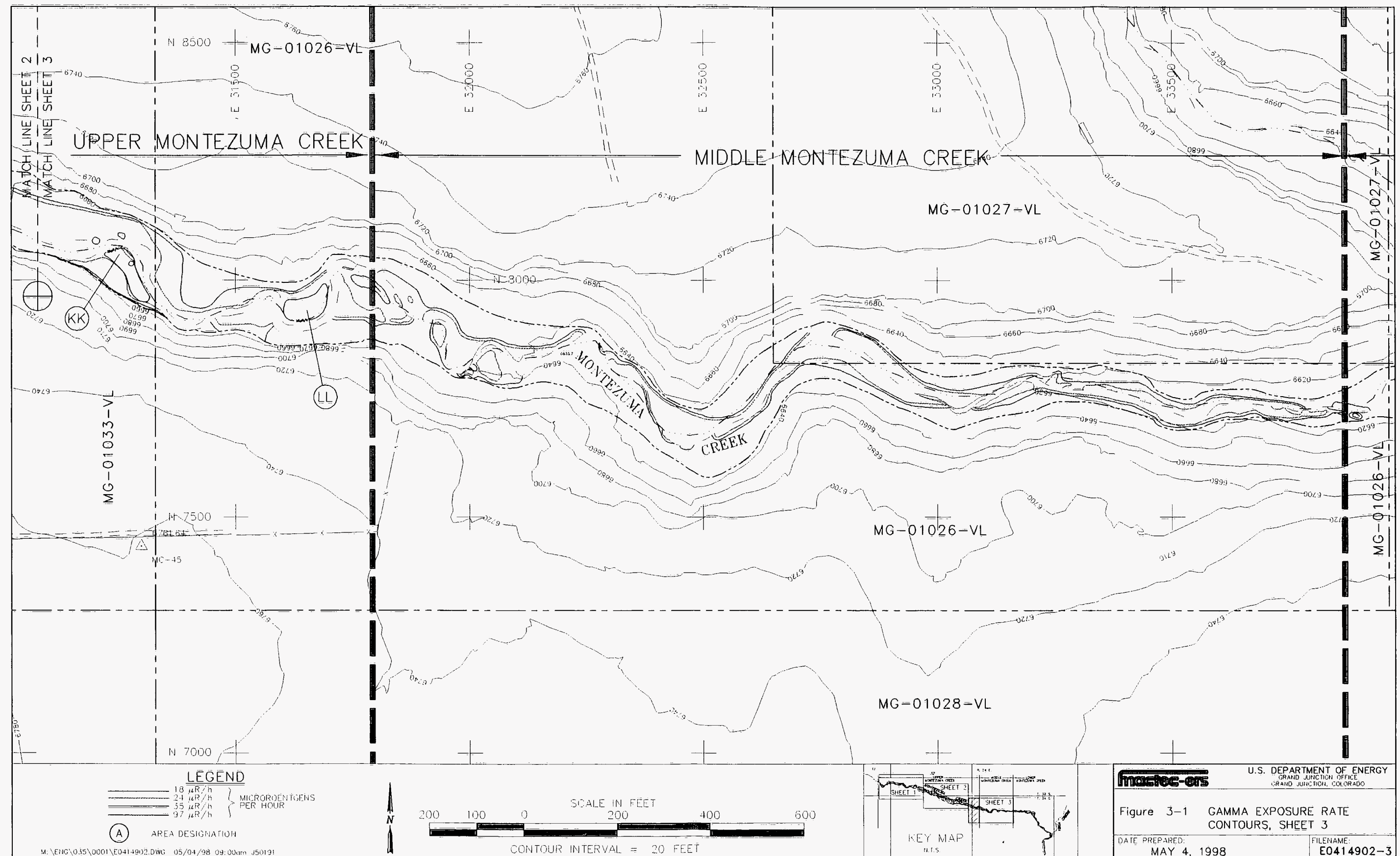


Figure 3-1 (continued). Gamma Exposure Rate Contours (Sheet 3)

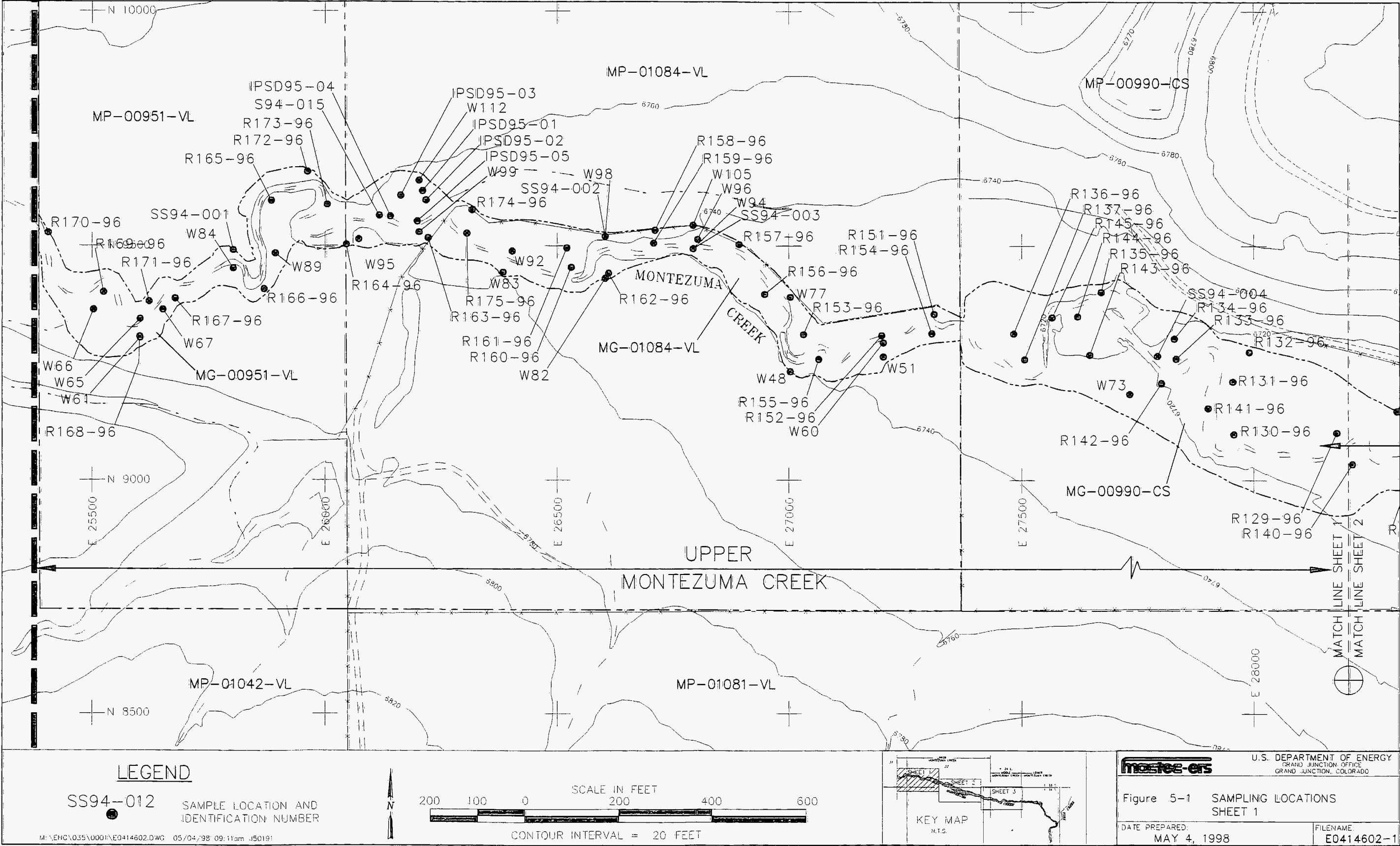


Figure 5-1. Sampling Locations (Sheet 1)

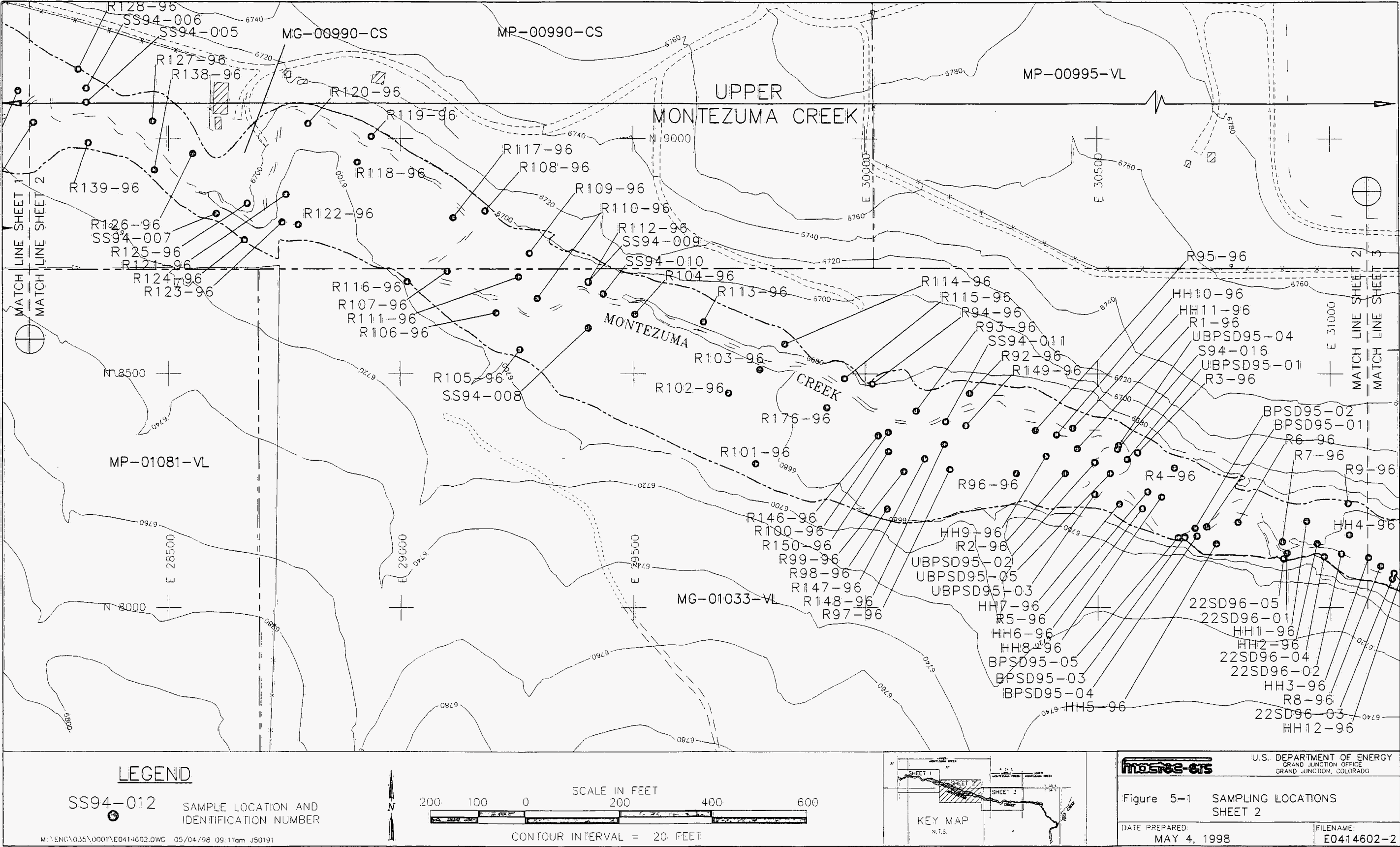


Figure 5-1 (continued). Sampling Locations (Sheet 2)

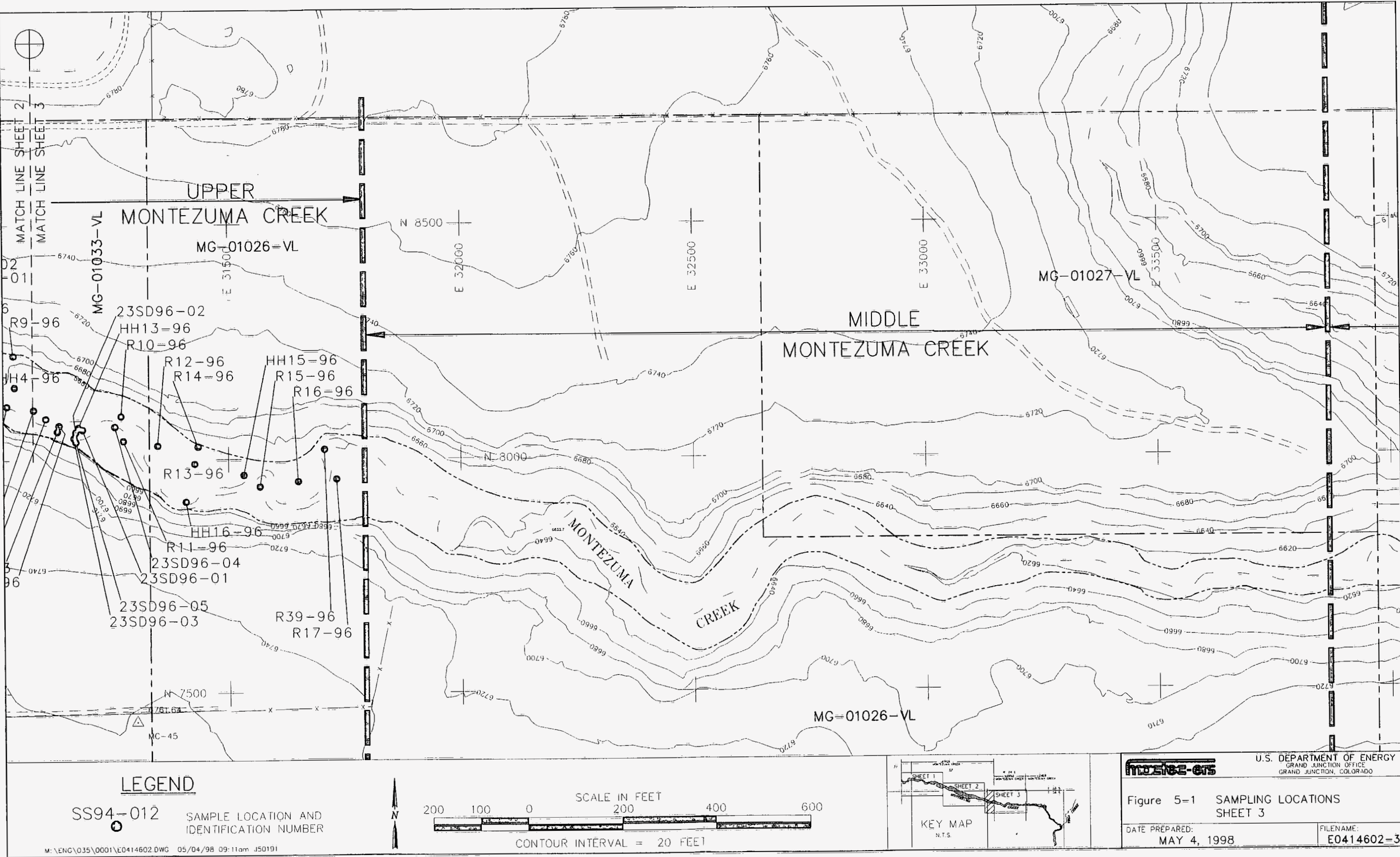


Figure 5-1 (continued). Sampling Locations (Sheet 3)

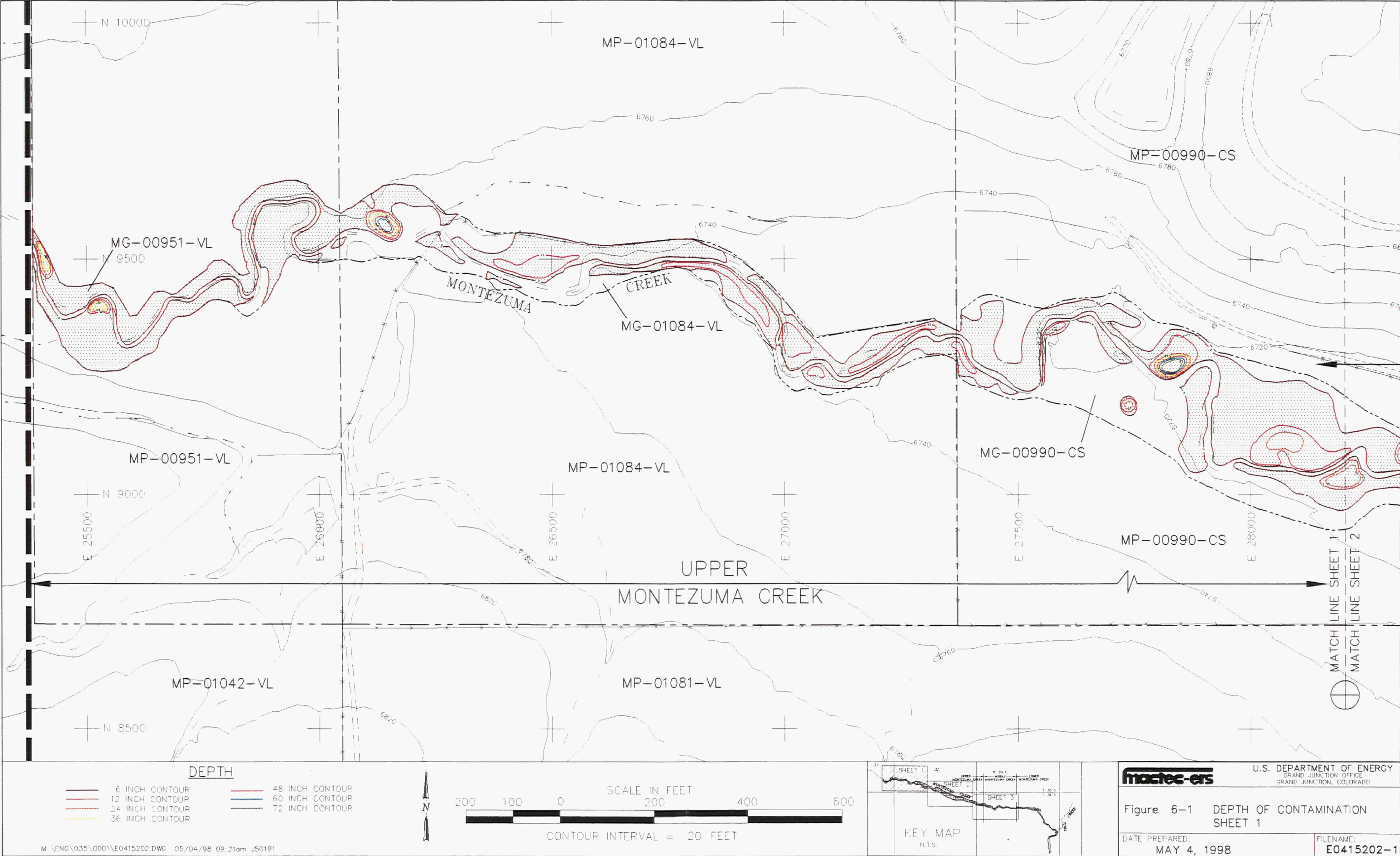


Figure 6-1. Depth of Contamination (Sheet 1)

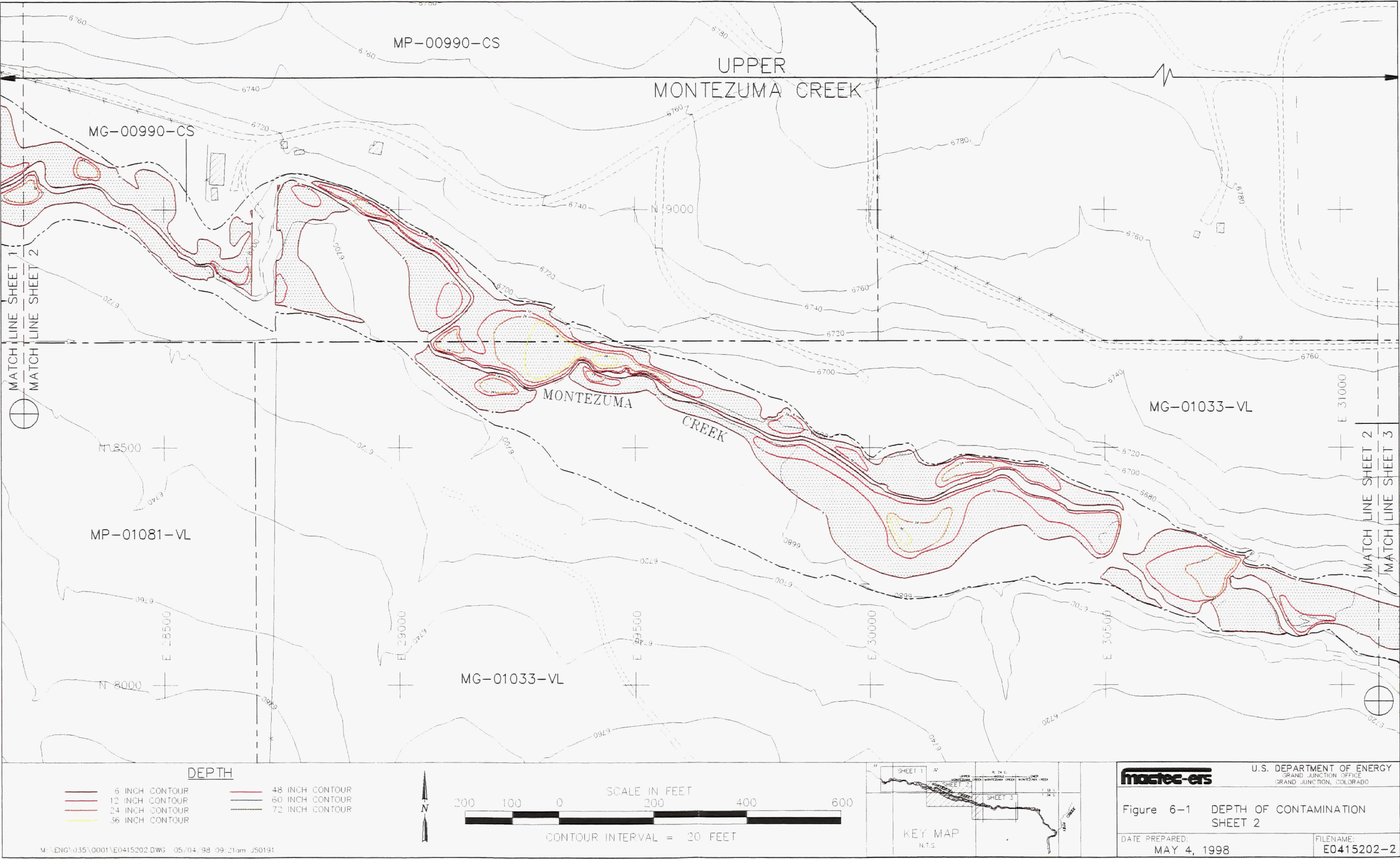


Figure 6-1 (continued). Depth of Contamination (Sheet 2)

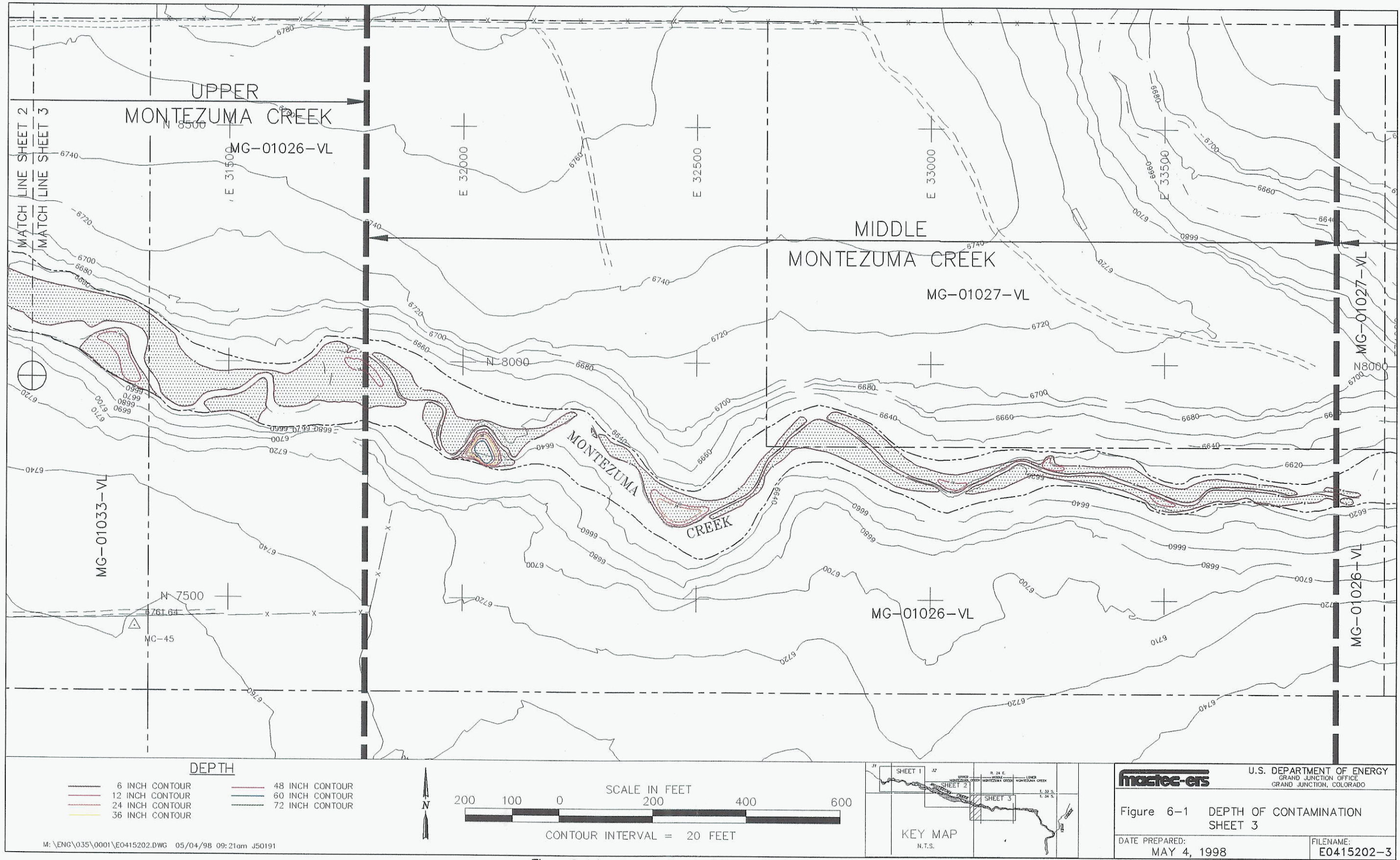


Figure 6-1 (continued). Depth of Contamination (Sheet 3)

Appendix B

Evaluation of Applicable or Relevant and Appropriate Requirements

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Evaluation of Applicable or Relevant and Appropriate Requirements

This appendix presents an evaluation of applicable or relevant and appropriate requirements (ARARs) for contaminated soil and sediment deposited on five properties in the Upper Montezuma Creek area (MG-01026-VL, MG-01033-VL, MG-00990-VL, MG-01084-VL, and MG-00951-VL). These properties are included in Operable Unit (OU) III of the Monticello Mill Tailings Site (MMTS). This appendix uses the *Monticello Mill Tailings Site Operable Unit III, Alternatives Analysis* (DOE 1997) ARARs evaluation and focuses it on the Upper Montezuma Creek soil and sediment removal action.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response action for the soil and sediment portion of OU III must comply with chemical-, location-, and action-specific ARARs and attain a degree of cleanup that ensures protection of human health and the environment. ARARs compliance must be met during the removal action as well as at its completion. In addition, remediation that leaves any hazardous substance, pollutant, or contaminant on site must meet a level or standard of control that at least attains standards, requirements, limitations, or criteria that are identified as ARARs for the site. Only substantive requirements must be met for on-site CERCLA activities; both substantive and administrative requirements must be met for off-site activities. It should be noted that permits are not required for on-site actions at CERCLA sites [40 CFR 300.400 (e)], but permit applications are, or have been, prepared for this design package to ensure that the proposed actions meet the regulatory intent.

Chemical-specific ARARs set health- or risk-based concentration limits for particular hazardous substances or contaminants in media such as air, soil, and water. The principal contaminants of concern associated with the Upper Montezuma Creek removal design are radioactive and nonradioactive substances associated with uranium and vanadium mill tailings. Location-specific ARARs establish additional requirements on the basis of unique characteristics of a site that could be affected as a result of the removal action. These ARARs may be used to restrict or preclude certain activities or removal actions on the basis of location or characteristics of a site. Action-specific ARARs are performance, design, and other requirements that control removal actions. These requirements are not concerned with contaminants present or with site characteristics and location, but address how removal action alternatives must be achieved. Action-specific requirements may specify particular performance levels, actions, or technologies, as well as specific levels (or a methodology for setting specific levels) for discharged or residual contaminants.

Section B.1.0 addresses Federal ARARs; Section B.2.0 addresses State ARARs; and Section B.3.0 addresses "To Be Considered" criteria.

B.1.0 Federal ARARs

This section addresses Federal requirements and identifies how each pertains to the Upper Montezuma Creek removal action.

Safe Drinking Water Act

The requirements of the Safe Drinking Water Act (SDWA) and its corresponding regulations address public water systems. The requirements are implemented by the State through a Federally approved program under the SDWA.

Federal Water Pollution Control Act, as amended by the Clean Water Act

Water-Quality Criteria—The water-quality criteria of this act and its corresponding regulations set water-quality standards on the basis of toxicity to aquatic organisms and human health, and regulate storm-water runoff discharges. The requirements are implemented by the State through federally approved programs under the Clean Water Act (CWA). The corresponding determination of ARARs is discussed in Section B.2.0 (Water Quality Rules, Standards for Quality for Water of the State, Groundwater Quality Protection, Underground Injection Control Program, and Utah Pollutant Discharge Elimination System).

Dredge or Fill Requirements (Section 404 of the Clean Water Act)—The provisions of 40 CFR 230 and 231 and 33 CFR 323 regulate activities associated with discharging dredged or fill material into waters of the United States. Navigable waters and isolated wetlands are protected under the jurisdiction of the U.S. Army Corps of Engineers (COE). A general permit (GP-40) was issued by the COE to the State of Utah authorizing the State Engineer to regulate the discharge of dredged or fill material into Utah streams. See the discussion in Section B.2.0 for an ARARs determination.

For CERCLA sites, the discharge of dredged or fill materials into waters of the U.S. (including wetland areas) is regulated by EPA rather than the COE. Wetland areas were identified and delineated throughout OU III. The *Monticello Wetlands Master Plan* (DOE 1996), which was developed to adhere to these applicable location- and action-specific requirements and which was approved by EPA, will be followed for wetland-area disturbance, remediation, and restoration activities associated with this soil and sediment remedy.

Clean Air Act

The requirements of this act and its corresponding regulations seek to protect and enhance the quality of the nation's air to protect public health and welfare and the productive capacity of the nation's population. The requirements are implemented by the State through the federally approved program under the Clean Air Act.

Resource Conservation and Recovery Act

The requirements of this act and its corresponding regulations address the generation and management of hazardous waste. The requirements are implemented by the State through the federally approved program under RCRA, as amended.

Uranium Mill Tailings Radiation Control Act

The requirements of this act and its corresponding regulations, promulgated at 40 CFR Part 192, are not applicable because the site does not meet the statutory or jurisdictional prerequisites that are applicable only to 24 specifically identified inactive uranium mill and tailings sites. However, because mill tailing contaminants have been dispersed into the environment from an inactive uranium processing site, these Federal requirements are relevant and appropriate chemical- and action-specific requirements for this removal action.

Cleanup standards for removal actions at inactive uranium processing sites are included in these requirements. These cleanup standards specifically apply to radium-226 (Ra-226) for land, and radon decay products and gamma radiation for buildings. 40 CFR 192.21 addresses criteria for which these cleanup standards can be changed to supplemental standards. Because the Ra-226 cleanup standards of 5/15 pCi/g Ra-226 are not met throughout the Upper Montezuma Creek by this removal action, the

application for supplemental standards will be necessary. Under these requirements, supplemental standards may be applied if remediation to 5/15 pCi/g Ra-226 would directly produce environmental harm that is clearly excessive compared to the health benefits received from remediation. Remediation to the Ra-226 standards would require a significant amount of excavation in environmentally sensitive areas and would adversely affect wetland areas and the habitat of ecological receptors. The cleanup levels included in this removal action reduce the amount of excavation required in the most environmentally sensitive areas to mitigate the adverse environmental effects of remediating to the 5/15 pCi/g Ra-226 standard and are protective of human health and the environment. The use of institutional controls also is required when supplemental standards are applied; restrictive easements will be used as the institutional control to ensure that habitable structures are not built within the OU III portion of Upper Montezuma Creek.

National Historic Preservation Act

The regulations implementing this act and its corresponding regulations at 40 CFR 6.301(b) require Federal agencies to take into account the effect of any federally assisted undertaking or licensing on a structure or object that is included on or eligible to the National Register of Historic Places (NRHP). The removal action planned for the Upper portion of Montezuma Creek will not impact or have any effect upon any structure or object that is included on or eligible to the NRHP. Therefore, these requirements are neither applicable nor relevant and appropriate to this removal action.

Archaeological and Historical Preservation Act

This act and its corresponding regulations establish procedures to provide for the preservation of historical and archaeological resources that may be destroyed through alteration of terrain as a result of a Federal construction project or a federally licensed activity or program. On the basis of recent archaeological survey results, removal actions identified in the engineering design for these properties (i.e., MG-01026-VL, MG-01033-VL, MG-0990-VL, MG-01084-VL, and MG-00951-VL) will have no impact on any known archaeological site; however, due to the relatively close proximity of the construction work to known archaeological resources/sites located in Montezuma Canyon, the potential exists to encounter a subsurface (unknown) archaeological site during removal activities. Therefore, these Federal regulations are considered applicable action- and location-specific requirements for removal activities associated with OU III.

Fish and Wildlife Coordination Act

This act and its corresponding regulations require consultation with the U.S. Fish and Wildlife Service (USFWS) whenever a Federal department or agency proposes or authorizes modification of any stream or other body of water and requires adequate provisions for the protection of fish and wildlife resources. Recent flora and fauna surveys identified no fish in Montezuma Creek within OU III, but showed that there may be temporary short-term loss of habitat for wildlife if the Montezuma Creek channel is modified. The removal actions identified in this design include such temporary actions as stream channel alteration/modifications, stream channel crossings, construction of impoundment structures, etc., and therefore, will impact the Montezuma Creek stream channel. To address these impacts, DOE has prepared a *Biological Assessment of MMTS Remedial Activities* (DOE 1998) and has requested a formal consultation with the USFWS. During construction activities, and prior to revegetation of disturbed areas, there may be a short-term loss of habitat for wildlife due to the disturbance and removal of vegetation associated with the areas of contamination. Consequently, these Federal requirements are relevant and appropriate location- and action-specific requirements for the removal actions associated with this design.

Endangered Species Act

This act and its corresponding regulations require that Federal agencies ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat required for the continued existence of that species. DOE has conducted surveys to determine if threatened or endangered species are present in Montezuma Creek. To date, no threatened or endangered species were identified at or near the MMTS or within OU III.

Flows to the San Juan River (and its tributaries) are protected under this act because endangered fish reside in the river. DOE is committed to designing its response action to ensure minimal (less than 100 acre-feet per year) depletion of flow to the San Juan River. Although the removal action for Upper Montezuma Creek will require rerouting the creek, flows within Montezuma Creek (which is tributary to the San Juan River) should not be significantly affected. DOE has prepared the *Biological Assessment of Monticello Mill Tailing Site Remedial Activities* (draft, January 1998), which discusses the effects of OU III activities on threatened and endangered species, and will submit this document of the U.S. Fish and Wildlife Service for a biological opinion. Because this removal action may temporarily affect flows within Montezuma Creek, a tributary of the San Juan River, these requirements are applicable location- and action-specific Federal requirements.

Bald and Golden Eagle Protection Act

This act and its corresponding regulations, which are administered by the U.S. Fish and Wildlife Service, provide for the preservation of the bald eagle and golden eagle through the protection of the individual raptor and its progeny. On the basis of survey information, neither bald nor golden eagles reside at or near the MMTS. Therefore, these Federal requirements are not applicable nor relevant and appropriate to the implementation of this removal action.

Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands)

These Presidential orders and their corresponding regulations require Federal agencies to evaluate actions they may take to avoid, to the maximum extent possible, adverse effects associated with direct and indirect development of a floodplain or wetland. The 10 CFR 1022 "Compliance with Floodplain/Wetlands Environmental Review Requirements" were issued to implement the requirements of Executive Orders 11988 and 11990. Activities associated with this removal action may affect site floodplains and wetlands. Therefore, these orders and their corresponding regulations are applicable Federal location- and action-specific requirements.

Farmland Protection Policy Act

The purpose of this act and its corresponding regulations is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of prime, unique, or important farmlands to nonagricultural uses. This requirement is administered through the U.S. National Resource Conservation Service. Because prime, unique, or important farmlands are not located within OU III, these Federal requirements are not applicable, nor relevant, and appropriate to this removal action.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) and its corresponding regulations are relevant and appropriate location- and action-specific Federal requirements for all federally funded projects and programs, including any activities associated with this OU III removal action. Additional guidance that

would be considered under NEPA includes regulations in the “Council on Environmental Quality” (40 CFR Part 1500); DOE NEPA regulations (10 CFR 1021); DOE Order 451.1, *Implementation of NEPA*; and *Secretarial Policy Statement on the National Environmental Policy Act* (issued June 1994). NEPA values have been and will be incorporated in the CERCLA documentation.

B.2.0 State of Utah ARARs

Because the MMTS is located in Utah, compliance with all State-specific environmental rules, regulations, standards, criteria, or limitations that are applicable or relevant and appropriate to OU III is mandatory. This section addresses State requirements and identifies how each may pertain to the Upper Montezuma Creek removal action. It is understood that the authorization process for allowing a State to implement a Federal program is generally a phased process. Because of this, the State may not have adopted a specific rule or portion of a regulatory program. In such instances, if a nonadopted rule or regulation in a State-implemented program is an ARAR, the Federal standards will apply.

Drinking Water

Drinking Water Rules—These rules represent the State’s implemented version of the Federal Safe Drinking Water Act’s National Primary and Secondary Drinking Water Regulations, which contain criteria and procedures to ensure a supply of drinking water that complies with established maximum contaminant levels. These rules include quality control and testing procedures that ensure proper operation and maintenance of a potable public water supply system; they specify the minimum quality of water that may be taken into the system, and they provide siting requirements for new facilities for public water systems. The rules also establish maximum contaminant levels that may be considered when establishing cleanup standards. Because the OU III alluvial aquifer is not used as a public water supply system, these requirements are not applicable. However, because the alluvial aquifer is of a quality that would allow it to be used as a drinking water source, and because the potential exists that the soil and sediment may contribute to the contamination of the aquifer, the Utah Drinking Water Rules are relevant and appropriate chemical-specific requirements for the surface-water and groundwater media in OU III.

Water Quality

The following regulations comprise the Utah State-implemented version of the Federal Clean Water Act program.

Water Quality Rules—The definitions for water pollution and the general requirements are applicable chemical-, location-, and action-specific requirements for this removal action.

Standards for Quality for Water of the State—The Clean Water Act provides criteria for states to set water-quality standards on the basis of toxicity to aquatic organisms and human health. Because the remediation of contaminated soil and sediment in the Upper Montezuma Creek area may result in a temporary discharge of contaminants (i.e., sediment) to Montezuma creek, these rules are applicable chemical-, location-, and action-specific requirements to the construction/removal activities identified in this removal action. Engineering controls to be employed during this removal action to capture and minimize the discharge of sediment to Montezuma Creek include the construction of sediment control ponds and filtration of sediment laden waters (i.e., sediment pillows, “dirt bags,” etc.).

Utah Pollutant Discharge Elimination System (UPDES)—The UPDES rules address point-source discharges of pollutants and storm-water runoff discharges into Utah waterways. They also address the use of injection wells (i.e., underground discharges of water) through the Underground Injection Control

Program. The UPDES point-source discharge rules are chemical-, location-, and action-specific requirements because groundwater may be pumped from construction excavations and discharged to Montezuma Creek. The UPDES Underground Injection Control Program is not applicable nor relevant and appropriate to this removal action design because underground injection will not be used. Additionally, because the total area of disturbance for this project is less than 5 acres, the UPDES storm-water runoff rules are not applicable State requirements; however, controlling sediment-laden runoff from the construction sites is considered to be a relevant and appropriate contaminant-specific requirement to the construction activities identified in this removal action. Implementation of this removal action through this design constitutes compliance with these requirements.

Groundwater Quality Protection—Utah-specific groundwater protection standards are addressed by this rule. An equivalent Federal program does not exist. These groundwater rules are applicable chemical-, location-, and action-specific State requirements for the surface-water and groundwater media in OU III and the corresponding selected remedy. Additionally, because the potential exists that the soil and sediment may contribute to the contamination of the alluvial aquifer, these groundwater rules are also applicable chemical-, location-, and action-specific State requirements for this removal action. Implementation of this removal action through this design constitutes compliance with these requirements.

Dredge or Fill Requirements (Section 404)—These rules, which are implemented by the State Engineer, are applicable location- and action-specific requirements for any dredge or fill activities in Montezuma Creek, including stream channel alterations, associated with the OU III soil and sediment remedy. Because removal actions in the Upper Montezuma Creek area will alter/reroute the existing stream channel, these requirements are applicable to the construction activities described in this design. *A Joint Permit Application Form U.S. Army Corps of Engineers—for Sections 404 and 10 Utah State Engineer's Office—for Natural Stream Channels* (included in Section B.4.0) has been prepared for activities which will alter the stream channel in the Upper Montezuma Creek area; however, the application will not be submitted to the State Engineer. It is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met.

Air Quality

The *Utah Air Conservation Rules* address the prevention and control of air pollution sources in Utah and establish air-quality emission standards and monitoring requirements. Because air emissions may occur as fugitive dust generated through the clearing of land, remediation of soil and sediment, use of construction equipment, and the construction and use of haul roads, the State-implemented version of the Federal National Primary and Secondary Ambient Air Quality Standards program, which establishes standards for ambient air quality, is an applicable chemical-, location-, and action-specific State requirement for the Upper Montezuma Creek removal action. This design includes the control of fugitive dust and dust emissions through the use of dust suppressants, including water.

Utah Hazardous Waste and Underground Storage Tank Management

Subpart C of RCRA addresses the generation, treatment, storage, disposal, and transportation of hazardous waste. A provision in 40 CFR 261.4(a)(4) excludes mill tailings (source, special nuclear, or by-product material, as defined by the Atomic Energy Act of 1954) from meeting the definition of a hazardous waste. Subpart I of RCRA regulates underground storage tanks (USTs) that are used to store regulated substances. On the basis of historical land-use knowledge and field investigations, it is very unlikely that hazardous waste or USTs will be encountered within OU III. However, if hazardous waste is discovered or generated, the hazardous waste rules are applicable chemical-, location-, and action-specific State requirements. Additionally, to the extent possible, hazardous waste will be managed in

accordance with the *Monticello Removal Action Project, Special Waste Management Plan for the Monticello Mill Tailings Site and Vicinity Properties* (DOE 1997d). The State UST requirements are not applicable nor relevant and appropriate to this removal action.

Corrective Action Cleanup Standards Policy for CERCLA and Underground Storage Tank Sites

This is a Utah-specific requirement which establishes a cleanup standards policy for CERCLA and UST sites. The policy sets forth criteria for establishing cleanup standards and requires source control or removal, and prevention of further degradation. This policy is an applicable chemical-, location-, and action-specific State requirement for this removal action. Implementation of this removal action through this design constitutes compliance with this requirement.

Radiation Control

The Utah Radiation Control rules address the management, including disposal and transportation, of radioactive materials. They also address standards for protection against radiation and licensing requirements. These rules are applicable chemical- and action-specific State requirements for this removal action. Compliance with these requirements is achieved by managing the uranium mill tailings as specified by this removal design.

Utah State History

These requirements address the protection of archaeological, anthropological, and paleontological resources on State lands and protection of these resources when they are associated with projects conducted or approved by State agencies. Such resources are not known to exist within the areas to be disturbed by these removal actions, and all areas affected by these removal actions are located exclusively on privately-owned properties. Therefore, these State requirements are not applicable to the activities associated with this removal action.

Water Rights

These requirements, which include well-drilling and abandonment standards, and consumptive uses of water (not already appropriated) are applicable action- and location-specific State requirements for this removal action. Consumptive uses of water include using the water for dust control (or other beneficial) purposes, evaporative loss through impoundment, irrigation, etc. Surface water will be impounded at two locations during the course of implementing the soil and sediment selected remedy described in this removal action for the Upper Montezuma Creek area. A sediment retention pond will be created at the location of an abandoned beaver dam site on Montezuma Creek located on property MG-01026-VL. The purpose of this structure is to extract and capture sediment that is introduced into Montezuma Creek during construction activities. An *Application to Appropriate Water* in the State of Utah (included in Section B.5.0) has been prepared to account for the evaporative loss that will occur from this pond during the temporary impoundment of Montezuma Creek at this location; however, this application will not be submitted to the State Engineer. It is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met. Additionally, an *Application for a Dam Not Requiring Submission of Formal Plans* is required for any dam meeting the exclusion under Section 73-5a-202 (dams under 20 acre-feet not constituting a threat to human life) of the Utah Code Annotated 1953, as amended (Utah Water Rights Law). This application also has been prepared and is included in Section B.6.0; however, this application will not be submitted to the State Engineer. It is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met.

The second location where water in Montezuma Creek will be impounded is at an irrigation pond located on property MG-01084-VL. An *Application to Appropriate Water* (in the State of Utah) is not required for this structure because water has been previously impounded and used at this location, and the water rights for this use are held by the current land owners.

B.3.0 To Be Considered Criteria

In addition to the legally binding laws and regulations discussed in Section B.1.0 and B.2.0, environmental and public health programs also develop criteria, advisories, guidance, and proposed standards that are not legally binding, but may provide useful information and recommended procedures. This section addresses such "To Be Considered" criteria that may be useful to help set cleanup-level targets and to ensure that the removal action is protective of human health and the environment.

Radiological Criteria for License Termination

In the Federal Register, Volume 62, July 21, 1997, the Nuclear Regulatory Commission (NRC) revised several regulations (10 CFR 20, 30, 40, 50, 51, 70, and 72) to provide specific radiological criteria for decommissioning lands and structures at NRC licensed facilities and facilities subject to NRC's jurisdiction. The NRC established a dose of 25 mrem/yr (from all man-made sources, excluding medical) as an acceptable criterion for release of any site for unrestricted use without further analysis of the potential for exposures from other man-made sources. The 25 mrem/yr dose is a To Be Considered criteria for the radiologically contaminated soil and sediment remedy addressed in this removal action.

B.4.0 Stream Channel Alteration Permit Application

Stream Channel Alteration

Activities that alter stream channels in the State of Utah are regulated by the State Engineer. Removal actions on MG-01026-VL, MG-01033-VL, MG-00990-VL, MG-01084-VL, and MG-00951-VL include removal of radiologically contaminated soils and sediments from approximately 6,930 linear ft of Montezuma Creek. The flow in Montezuma Creek will be temporarily rerouted during these removal actions to facilitate remediation of the contaminated portions of the stream channel. A completed *Joint Permit Application Form U.S. Army Corps of Engineers—for Sections 404 and 10 Utah State Engineer's Office—for Natural Stream Channels* is attached to this Appendix to demonstrate the intent of the CERCLA removal action to comply with all applicable requirements. The Application will not be formally submitted to the State Engineer.

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JOINT PERMIT APPLICATION FORM

U. S. ARMY CORPS OF ENGINEERS - FOR SECTIONS 404 AND 10

UTAH STATE ENGINEER'S OFFICE - FOR NATURAL STREAM CHANNELS

Application Number _____ / _____
 (Assigned by: _____) Corps _____ State Engineer _____

Applicant's Name (Last, First M.I.) U.S. Department of Energy - Grand Junction Office	Telephone Number and Area Code 970-248-7612
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Applicant's Address (Street, RFD, Box Number, City, State, Zip)

2597 B 3/4 Road, Grand Junction, CO 81503

PROJECT LOCATION

Quarter Section(s)	Section Section 32 of Section 4, 5 of	Township T.335 T.345	Range R.24E	Base & Meridian Salt Lake
County San Juan	Watercourse to be altered Montezuma Creek		Check one: <input type="checkbox"/> Within city limits <input checked="" type="checkbox"/> Outside city limits List town or nearest town: Monticello, Utah	

Project location or address: That portion of upper Montezuma Creek to be temporarily rerouted on DOE ID Nos. MG-00990-VL, MG-01033-VL, and MG-01026-VL.

Brief description of project:

Water in Montezuma Creek will be temporarily rerouted to facilitate the remediation and removal of uranium mill tailings contamination within the existing stream channel. The stream will be diverted and rerouted through 18" PVC pipe for approximately 2000 linear ft. It is anticipated that the stream channel will be diverted for approximately 6 months, after which it will be returned to the reclaimed, pre-existing stream channel.

Purpose (justification) of project:

Radiological contamination associated with the former uranium mill located approximately 2 miles upstream, has been identified in the existing stream channel. In order to remove contamination from a 2000 foot section of Montezuma Creek, the water must be diverted/rerouted. Radiological contamination identified at these properties has been determined to pose an unacceptable risk to human health and the environment, and therefore must be removed according to the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Is this a single and complete project or is it part of a larger project, continuing project, or other related activities? If so, please describe the larger project or other related activities. The activities described in this application are part of a larger removal action taking place at the Monticello Mill Tailings Site (MMTS). Other activities associated with the MMTS include the identification, removal and verification of radiological contamination from: 1) The former millsite; 2) peripheral properties; 3) vicinity properties; and 4) contaminated surface and groundwater.

If project includes the discharge of dredged or fill material:

Cubic yards of material: -N/A- Sediment generated during removal activities will be captured and controlled throughout the project by the sediment control pond and by using "dirt bags" or sediment filtration pillows, thereby eliminating any net discharge to Montezuma Creek

Acreage or square footage of waters of the United States, including wetlands, affected by the project:

Approximately 50,000 ft² or 1.15 acres

Source and type of fill material: - N/A -

Alternatives (other ways to accomplish the project purpose):

An Alternatives Analysis for the Monticello Mill Tailings site (MMTS) Operable Unit III was prepared in January 1998. Removal of contaminated sediment and soils from this portion of Montezuma Creek using an alternate clean-up level and the application of supplemental standards (40 CFR 192.22) is the selected remedy.

Names and addresses of adjacent property owners or other individuals who may be affected by this project:

1. Bryan and Sherrill Bowring, Monticello, UT.
2. Robert and Relva Bowring, Monticello, UT.
3. Sutherland Brothers, Inc., Monticello, UT.

List other authorizations required by Federal, state or local governments (i.e.; National Flood Insurance Program), and the status of those authorizations. Federal, state, or local authorizations or permits are not required for on-site response actions conducted pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). See 40 CFR 300.400 (e). This application will not be submitted to the State Engineer for review/approval. It is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met.

Estimated starting date of project

May, 1998

Estimated completion date

May, 1999

(If project has already been partially or totally completed, indicate date of work. Indicate existing work on drawings).

Application is hereby made for a permit or permits to authorize the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities or am acting as the duly authorized agent of the applicant.

Signature of applicant

Date

I hereby certify that _____ is acting as my agent for this project.

Agent's address and telephone number

INSTRUCTIONS

Applications which do not include the following will not be processed.

For a complete application, you **MUST** include the following on 8 1/2 by 11 paper (for large projects, multiple sheets with a key may be used). Clear, hand-drawn plans approximately to scale are acceptable.

1. An accurate location map (USGS quadrangle map preferred)
2. A plan view of the proposed activity (as seen from above) including dimensions of work.
3. A cross-section view of the proposed activity (may use typical cross-section for large projects) including dimensions.
4. For projects which include wetlands, an accurate wetland delineation must be prepared in accordance with the current method required by the Corps.

B.5.0 Application to Appropriate Water

Water Appropriation

These requirements apply to the appropriation of water in the State of Utah. An application to appropriate water is required to account for the evaporative loss of water that will occur from the creation of the sediment control pond located on MG-01033-VL. A completed *Filing for Water in the State of Utah Application to Appropriate Water* is attached to this Appendix to demonstrate the intent of the CERCLA removal action to comply with all applicable requirements. The Application will not be formally submitted to the State Engineer.

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FILING FOR WATER IN THE STATE OF UTAH

Rec. by _____

Fee Rec. _____

Receipt # _____

Microfilmed _____

Roll # _____

APPLICATION TO APPROPRIATE WATER

For the purpose of acquiring the right to use a portion of the unappropriated water of the State of Utah, application is hereby made to the State Engineer, based upon the following showing of facts, submitted in accordance with the requirements to Title 73, Chapter 3 of the Utah Code Annotated (1953, as amended).

*WATER RIGHT NO. _____ - _____

*APPLICATION NO. A

1. *PRIORITY OF RIGHT: _____ *FILING DATE: _____

2. OWNER INFORMATION

Name(s): U.S. Department of Energy *Interest: _____ %Address: 2597 B 3/4 RoadCity: Grand Junction State: Colorado Zip Code: 81503Is the land owned by the applicant? Yes _____ No X (If "No", please explain in EXPLANATORY section.)

3. QUANTITY OF WATER: _____ cfs and/or _____ ac-ft.

4. SOURCE: Montezuma Creek *DRAINAGE: _____which is tributary to San Juan Riverwhich is tributary to Colorado RiverPOINT(S) OF DIVERSION: _____ COUNTY: San JuanApproximately south 825 feet and east 264 feet from the northwest corner of
Section 4, Township 34 south, Range 24 east, Salt Lake Base and Meridian.Description of Diverting Works: Sediment Control Pond

*COMMON DESCRIPTION: _____

5. POINT(S) OF REDIVERSION

The water will be rediverted from -N/A- at a point: _____

Description of Diverting Works: _____

6. POINT(S) OF RETURN

The amount of water consumed will be _____ cfs or 2.6 ac-ft.The amount of water returned will be -N/A- cfs or _____ ac-ft.The water will be returned to the natural stream/source at a point(s): -N/A-

7. STORAGE

Reservoir Name: Upper Creek Sediment Pond#1 Storage Period: from 6/98 to 6/2000Capacity: 1.37 ac-ft. Inundated Area: 0.4 acres.Height of dam: 5 feetLegal description of inundated area by 40 acre tract(s): NW 1/4 NW 1/4, Section 4, Township 34 South,
Range 24 east, Salt Lake Base and Meridian, San Juan County, Utah.

* These items are to be completed by the Division of Water Rights

Appropriate

8. List any other water rights which will supplement this application. None

9. NATURE AND PERIOD OF USE

Irrigation:	From _____	to _____
Stockwatering:	From _____	to _____
Domestic:	From _____	to _____
Municipal:	From _____	to _____
Mining:	From _____	to _____
Power:	From _____	to _____
Other:	From <u>6/98</u>	to <u>6/2000</u>

10. PURPOSE AND EXTENT OF USE

Irrigation: -N/A- acres. Sole supply of _____ acres.
Stockwatering (number and kind): -N/A-
Domestic: -N/A- Families and/or _____ Persons.
Municipal (name): -N/A-
Mining: -N/A- Mining District in the _____ Mine.
Ores mined: _____
Power: Plant name: -N/A- Type: _____ Capacity: _____
Other (describe): Construction of sediment control pond is necessary to capture sediment resulting from on-site removal activities, and to prevent releases of sediment to downstream locations.

11. PLACE OF USE

Legal description of place of use by 40 acre tract(s): Upper Montezuma Creek sediment control pond located in the NW 1/4 of the NW 1/4 of Section 4, Township 34 south, Range 24 east, Salt Lake Base and Meridian, San Juan County, Utah.

12. EXPLANATORY

The following is set forth to define more clearly the full purpose of this application. (Use additional pages of the same size if necessary): No water will actually be diverted from the sediment control pond described in this application. The purpose of this application is to account for the volume of evaporative loss that has been calculated for the sediment control pond. This application will not be submitted to the State Engineer for review/approval. This application is included in this design only to demonstrate that the applicable, substantive regulatory intent has been met. Permits are not required for on-site response actions conducted at CERCLA sites [40 CFR 300.400 (e)].

The applicant(s) hereby acknowledges that he/she/they are a citizen(s) of the United States of America or intends to become such a citizen(s). The quantity of water sought to be appropriated is limited to that which can be beneficially used for the purposes herein described. The undersigned hereby acknowledges that even though he/she/they may have been assisted in the preparation of the above-numbered application through the courtesy of the employees of the Division of Water Rights, all responsibility for the accuracy of the information contained herein, at the time of filing, rests with the applicant(s).

Signature of Applicant(s)*

*If applicant is a corporation or other organization, signature must be the name of such corporation or organization by its authorized agent, or in the name of the partnership by one of the partners.

Authorized Agent (please print)

Authorized Agent (signature)

B.6.0 Dam Application Not Requiring Submission of Formal Plans

Dam Application

An *Application for a Dam Not Requiring Submission of Formal Plans Under Section 73-5A-202 State of Utah* is required for any dam meeting the exclusion under Section 73-5a-202 (dams under 20 acre-feet not constituting a threat to human life) of the Utah Code Annotated 1953, as amended (Utah Water Rights Law). A completed *Application for a Dam Not Requiring Submission of Formal Plans Under Section 73-5A-202 State of Utah* is attached to this Appendix to demonstrate the intent of the CERCLA removal action to comply with all applicable requirements. The Application will not be formally submitted to the State Engineer.

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APPLICATION FOR A DAM NOT REQUIRING SUBMISSION OF FORMAL PLANS UNDER SECTION 73-5A-202

STATE OF UTAH

Application No. _____
Received _____
Entered _____

The following application is submitted pursuant to Section 73-5a-204 for a dam meeting the exclusion under Section 73-5a-202(1) (dam under 20 acre-feet not constituting a threat to human life) or the waiver under Section 73-5a-202(3) (dams over 20 acre-feet not constituting a threat to human life or property not held by the owner of the dam).

1. APPLICANT INFORMATION

Name(s): U.S. Department of Energy - Grand Junction Office

Address: 2597 B 3/4 Road

City: Grand Junction State: Colorado Zip Code: 81503

2. PURPOSE OF DAM

Stock Pond _____	Regulating Res. _____	Diversion Dam _____
Irrigation _____	Debris Basin _____	Flood Control _____
Sedimentation <u>X</u>	Tailings Pond _____	Recreation _____
Other (describe) _____		

3. LOCATION OF DAM

County San Juan Quarter/Quarter (i.e. NESW) NWNW Section 4
Township T. 34.5 Range R. 24 E Base & Meridian Salt Lake

4. PROPOSED DAM

Dam Height (vertical distance) 5 feet
Crest Length (length of top of dam) 250 feet
Crest Width (width of top of dam) 2 feet
Upstream slope 3 vertical on 1 horizontal
Downstream slope 2 vertical on 1 horizontal
Water surface area at spillway crest 0.4 acres
Reservoir capacity at spillway crest 1.37 ac-ft.
Type of dam (i.e. earthfill, concrete, etc.) earthen fill

5. PROPOSED OUTLET

Inside diameter -N/A- inches Length _____ feet
Type of pipe (i.e. concrete, steel, etc.) -N/A-
Type of gate or valve -N/A-
Location of gate (upstream, downstream, center, etc.) -N/A-

6. PROPOSED SPILLWAY

Crest Length (width of bottom of spillway) 4 feet
Depth (from bottom of spillway to top of dam) 3 feet
Type (i.e. earth channel, pipe, etc.) earth channel

Control (i.e. gates, flashboards, etc.) silt & sediment controls

7. WATER RIGHTS

Describe (see instructions) The proposed dam will be constructed at the location of a former beaver pond/dam for the purposes of capturing sediment discharged to Montezuma Creek as a result of uranium mill tailings and associated contamination removal activities in the upper Montezuma Creek area. The evaporative loss associated with impounding water at this location will be negligible; however, an application to appropriate water has been prepared to account for this volume of water.

8. COMMENTS

Permits are not required for on-site response actions conducted at CERCLA sites
[40 CFR 300.400 (e)]. This application will not be submitted to the State Engineer
for review/approval. It is included in this design only to demonstrate that the
applicable, substantive regulatory intent has been met.

9. PLANS

Attach plans sketches or diagrams to clarify the information given on this application.

The undersigned acknowledge they have read the instructions included with this application, and are aware no construction is to begin until this application has been approved by the Utah State Engineer.

Date

Signature of Applicant

Water Rights in Order By _____ Date _____

Area Engineer's Hazard Rating _____

Reviewed by Dam Safety By _____ Date _____

Comments _____

Date of Approval _____

Robert L. Morgan, P.E.
State Engineer

Appendix C

Legal Descriptions of Properties

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DOE ID Number MP-00951-VL

Location: Montezuma Creek, Upper Canyon

Owner: Bryan E. Bowring

Sherrill Bowring

Robert S. Bowring

Relva S. Bowring

(B.760, P.605-606)

Parcel Number: 33S24E317200

Beginning at a point 660 feet south of the E $\frac{1}{4}$ corner of Section 31, T33S, R24E, Salt Lake Base and Meridian, San Juan County, Utah; thence south, 1,980 feet to the southeast corner of said Section 31; thence west, 660 feet; thence north, 1,980 feet; thence east, 660 feet to the point of beginning; except the following described portion thereof: beginning 660 feet south of the E $\frac{1}{4}$ corner of said Section 31, thence west, 225 feet; thence south, 275 feet; thence east, 225 feet; thence north, 275 feet to the point of beginning; and also except road right-of-way for Clayhill Drive.

DOE ID Number MP-00990-CS

Location: Montezuma Creek, Upper Canyon

Owner: Sutherland Brothers, Inc.

(B.673, P.583-584)

Parcel Number: 33S24E324800

The S $\frac{1}{2}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$, and the SE $\frac{1}{4}$ SW $\frac{1}{4}$, and the W $\frac{1}{2}$ SE $\frac{1}{4}$, all within Section 32, T33S, R24E, Salt Lake Base and Meridian, San Juan County, Utah; except the following described portion thereof: beginning at a point on the east boundary of the SW $\frac{1}{4}$ SE $\frac{1}{4}$ of said Section 32, said point being north 89° 59' 47" west, 1,325.22 feet and north 0° 05' 12" west, 660.43 feet from the southeast corner of said Section 32; thence north 45° 07' 48" west, 935.47 feet to a point on the south boundary of the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of said Section 32; thence north 45° 07' 26" west, 934.68 feet to a point on the west boundary of said NW $\frac{1}{4}$ SE $\frac{1}{4}$; thence north 0° 01' 54" west, along said west boundary 659.94 feet to the center of said Section 32; thence north 89° 55' 07" east along the north boundary of the NW $\frac{1}{4}$ SE $\frac{1}{4}$ of said Section 32 a distance of 1,322.69 feet to the northeast corner of said NW $\frac{1}{4}$ SE $\frac{1}{4}$; thence south 0° 05' 12" east, along the east boundary of the W $\frac{1}{2}$ SE $\frac{1}{4}$ of said Section 32 a distance of 1,981.28 feet to the point of beginning.

DOE ID Number MG-01026-VL

Location: Montezuma Creek, Middle Canyon

Owner: Sutherland Brothers, Inc.

(B.673, P.583-584)

Parcel Number: 34S24E043000

Lots 3 and 4 of Section 4, T34S, R24E, Salt Lake Base and Meridian, San Juan County, Utah; except the following described portion of said Lot 3: beginning at the northeast corner of said Lot 3; thence south, 900 feet along the east line of said Lot 3; thence west, 1,320 feet to the west line of said Lot 3; thence north, 900 feet to the northwest corner of said Lot 3; thence east, 1,320 feet, more or less, to the point of beginning.

DOE ID Number MG-01033-VL

Location: Montezuma Creek, Upper Canyon

Owner: Sutherland Brothers, Inc.

(B.673, P.583-584)

Parcel Number: 34S24E050000

Lots 1 and 2, Section 5, T34S, R24E, Salt Lake Base and Meridian, San Juan County, Utah.

DOE ID Number MP-01084-VL

Location: Montezuma Creek, Upper Canyon

Owner: Bryan E. Bowring

Sherrill Bowring

Robert S. Bowring

Relva S. Bowring

(B.760, P.605-606)

Parcel Number: 33S24E326000

The S½ NW¼ SW¼, and the SW¼ SW¼, all within Section 32, T33S, R24E, Salt Lake Base and Meridian, San Juan County, Utah; except the following described portion thereof: beginning at a point located north 1,974.2 feet and east 167.1 feet from the southwest corner of Section 32, T33S, R24E, Salt Lake Base and Meridian, San Juan County, Utah; thence east, 1,154.6 feet (more or less) to the sixteenth section line; thence south, 1,011.88 feet to the intersection of a gravel road; thence along the centerline of the existing gravel road the following nine (9) courses:

- 1.) N. 51°22' west, 332.5 feet;
- 2.) N. 10°55' east, 152.9 feet;
- 3.) N. 22°36' west, 69.5 feet;
- 4.) N. 78°02' west, 132.9 feet;
- 5.) N. 58°46' west, 117.1 feet;
- 6.) N. 42°12' west, 399.5 feet;
- 7.) N. 57°01' west, 98.8 feet;
- 8.) N. 68°57' west, 220.2 feet;
- 9.) N. 56°28' west, 134.5 feet; to the point of beginning, except road right-of-way for Clayhill Drive.

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Reference: U.S. Department of Energy. March 1998. *Monticello Mill Tailings Site Operable Unit III Surface- and Ground-Water Feasibility Study, Draft-Final*, GJO-97-21-TAR, (GJO-MRAP-40), prepared by MACTEC-ERS for the U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado.

Type: Report

Location: Oversized document shelf